REPORT

ON

The Enquiry to bring Technical Institutions into closer touch and more practical relations with the Employers of Labour in India.

AGENTS FOR THE SALE OF BOOKS

PUBLISHED BY THE

Superintendent of Government Printing, India, Calcutta.

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Constable & Co., 10, Orange Street, Leicester Square, W. C.

Kegan Paul, Trench, Trübner & Co., 68-74, Carter Lane, E. C.

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H. Liddell, Printer, etc., 7, South Road, Allahabad.*

D. C. Anand & Sons, Peshawar.*

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Digitized with financial assistance from

Shri Brihad Bhartiya Samaj

on 31 October, 2019

REPORT

ON

The Enquiry to bring Technical Institutions into closer touch and more practical relations with the Employers of Labour in India.

BY

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AND

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CALCUTTA
SUPERINTENDENT GOVERNMENT PRINTING, INDIA
1912

Price Ten Annas or One Shilling.

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CHAPTER I.

GENERAL OBJECT OF THE ENQUIRY.

The demand for technical education in India.

1. During recent years, there has been a continuous and insistent demand from all parts of India for an extension of technical education, and proposals for the establishment of institutions for teaching the most varied subjects have been made. The examples of England, America, Germany and Japan have been freely quoted as possessing numerous colleges and schools, and as affording various facilities for technical education and scientific industrial training. It seems to be forgotten, more often than remembered, that these countries possess a wealth of manufactures, factories and workshops, which India does not possess, and in them, the growth of manufactures, factories and workshops, preceded the establishment of technical schools and colleges. Nevertheless, a large portion of articulate Indian opinion seems to understand that if only a sufficient number of technical institutes are established, and a sufficient number of men are trained to take up appointments as managers, foremen, etc., the establishment of manufacturing concerns must follow, and the industrial regeneration of India will be assured.

If it is admitted that in every other country technical education has followed the organization of industries,[1] or grown up alongside with them, and may be said to be the necessary complement to industrial efficiency, it is obvious that in a country where few industries are established, the wholesale education of Indians could only result in an excess of young men trained up for posts which do not exist, and for whom no suitable occupation can be found.

The conditions under which technical education can be successfully carried on.

2. The question whether technical education is of any assistance at all depends firstly on the general aptitude of the subject for this line of work. It is useless training a man in mechanical engineering who will not take off his coat and work, whose physique will not stand the strain, or whose social customs make manual work repugnant.[2] Secondly, the question depends on the general business aptitude and energy of the race, whether capital and commercial confidence is forthcoming to start enterprises, and perseverance and grit in the application of technical knowledge to ensure a successful outcome for these ventures. Captains of industry are not turned out mechanically in technical institutions, and every technically trained student must be prepared to start on the lowest rung of the ladder, show his superiority by hard work and technical knowledge, and having made himself indispensable and a commercial asset to his employer, he will then rise by the natural laws of supply and demand.

The conditions existing in England at the present day.

3. As regards the position in England at the present day,[3] Professor W. C. Unwin recently remarked, "a very great obstacle to the progress of technical education in this country has been the want of any definite aim, and the unsuitable character of our secondary education."

It is therefore necessary to have a definite aim before us in any scheme for technical education.

The evils of over education.

4. It is generally admitted that higher literary education in India can be overdone, the result being the production of a large number of educated men who cannot find employment commensurate with their qualifications. In the same way technical education may prove a curse instead of a blessing, if it turns out a number of men who cannot obtain employment, either owing to the inefficiency of the education, or to the fact that it has been conducted on wrong lines, or because suitable and remunerative employment does not yet exist.

The objects of the enquiry

5. In order to bring the technical institutes of India into closer touch and more practical relations with employers of labour, and to study the existing requirements for technically trained Indians, together with the probabilities of

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[1] See paragraphs, 77, 85.
[2] See paragraphs 28 to 31 and paragraph 40.
[3] Presidential address to the Institute of Civil Engineers, 1911.

an increased sphere of employment for them in various trades and professions, we were deputed by the Government of India to enquire into the following points :—

(*a*)[1] What openings exist for the employment of technically trained Indians, and what further openings are likely to be available?

(*b*)[2] What type of man and standard of education and training do employers of labour demand in the various industries?

(*c*)[3] Have these demands been met by the existing technical institutions?

(*d*)[4] If not, how should these institutions be altered or added to, in order that they should be in a position to meet these demands?

(*e*)[5] What arrangements can be made for systematic co-ordination between institutes and employers of labour, in order that they may work in with each other for their mutual benefit and for the good of the country?

The last point is perhaps the most important of all, and it may be noted that even now, it is a burning question in the complex industrial organization of the West. The following remarks were made in 1911 by the President of the Institute of Civil Engineers:—

"With an experience of twenty years, I believe that more organized and recognized relations between the schools and offices and works are desirable and possible * * * * * * * . I am much in sympathy with the proposal Mr. Yarrow placed before the Conference,[6] that there should be an endeavour to produce some co-ordination between the colleges and the employers, by making an enquiry as to the conditions under which well qualified students may be able to get practical training, whether they seek employment later in the mechanical or electrical branches or in constructional or administrative work."

The places visited.

6. We were directed to visit the different centres of industry, interview the various employers of labour, and the staff of large industrial concerns, whether controlled privately or by Government, and to obtain the opinions of all who could give any information which would enable us to formulate some definite proposals for submission to Government.

The scope of our enquiry has covered Bengal, the Central Provinces, Bombay Presidency, Madras Presidency, the United Provinces, and the Punjab. In each of these provinces all the principal workshops and industrial concerns have been visited, the managers and heads of departments have been interviewed and their opinions obtained. A general outline of these interviews will be found in Part II. It is with sanction that these are published, but we are in no way responsible for the opinions expressed.

The officers associated with us.

7. In the various provinces visited, the following officers were associated with us in our enquiry.

BENGAL.—Mr. W. H. EVERETT, Officiating Inspector of Technical Institutes, and Superintendent of Industries.

BOMBAY.—Mr. H. N. ALLEN, Principal, the College of Engineering, Poona.

UNITED PROVINCES.—Mr. W. R. WILSON, Director of Industries.

CENTRAL PROVINCES.—Mr. A. C. WRIGHT, Director of Public Instruction.

MADRAS.—The Hon'ble Mr. A. G. BOURNE, Director of Public Instruction.

The professions included in the enquiries.

8. The professions included in our enquiries are—

1. Civil Engineering.
2. Mechanical Engineering.
3. Electrical Engineering.
4. Textile Manufacture.
5. Mining Engineering.
6. Industrial Chemistry.

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[1] See paragraphs 27, 28, 47.
[2] See paragraphs 41 and 42.
[3] See Part IV.
[4] See Chapter V, Chapter XVI, paragraph 207, Chapters XVIII, XIX, XX, XXI.
[5] See paragraphs 45 and 46 and Recommendation 12, Chapter VII.
[6] Conference held at the Institution of Civil Engineers, 1911.

9. The inception, organization or improvement of industries is excluded from the scope of our enquiries. The exclusion of industries.

THE GRADES OF THE PERSONNEL OF THE PROFESSIONS INCLUDED IN THE ENQUIRY.

10. The grades in this profession in India are well marked. Civil Engineering.

(*a*) The Engineer.

(*b*) The Overseer.

(*c*) The Sub-overseer, work agent and surveyor.

(*d*) The Draftsman and computer.

11. These professions may be divided into three grades corresponding to those in Civil Engineering, but their nomenclature is more difficult. Mechanical and Electrical Engineering.

(*a*) The mechanical and electrical engineer of the highest grade, is one who by his theoretical and practical knowledge is in a position to advise, design, manufacture, and control the working of machinery and plant of every description in his profession. He will be concerned with economic, legal, and commercial problems of much intricacy and must be prepared to meet men of affairs and liberal education on an equal footing.

(*b*) The second grade may be termed the "Improver" for want of a better name. He is a man who should have a fair theoretical and a great amount of practical knowledge. His work will be multifarious but will include under :

Mechanical Engineering.

Supervision and repair of running machinery, independently in the case of plant of moderate dimensions.
Engineering draftsmen.
Workshop foremen and chargemen.
Engineers for mills, workshops, pumping installations, electric power stations, ginning and pressing factories, rice hulling factories, etc., etc.
Engineers for mines and railways.
Gas engineers.

Electrical Engineering.

Electrical draftsmen.
Superintendents and assistants in power stations.
Chargemen for small installations.
Wiring aud installation foremen.
Switchboard attendants.
General maintenance workmen.

(*c*) Mechanics.

12. The grades are— Textile Engineering.

(*a*) Managers.

(*b*) Weaving, carding, spinning masters, and engineers.

(*c*) Assistants to (*b*) who would take subordinate charge of some of the following branches :—

1. Scutching.
2. Carding.
3. Preparation and spinning.
4. Weaving.
5. Sizing.
6. Dyeing.
7. Bleaching.
8. Finishing.
9. Cloth designing and analysis.

(*d*) Jobbers or mistries.

Mining Engineering.

13. The grades are—

(*a*) Superintendents and managers.
(*b*) Assistants, overlookers and engineers.
(*c*) Surveyors.
(*d*) Sirdars.

The consideration of the training required for mining engineering is dealt with in Chapter XVI.

Industrial Chemistry.

14. This cannot be divided into defined grades, but the subjects in which India is interested seem to be—

1. Sugar.
2. Oils and fats.
3. Bleaching and sizing materials.
4. Dyeing materials.
5. Soaps and candles.
6. Food and drug inspectors.
7. Metallurgy.

Industrial Chemistry is dealt with in paragraph 219.[1]

15. The general result of our inquiry (which is dealt with in detail in Chapter VII) is, we are glad to say, very favourable. A large number of openings undoubtedly exist for the employment of technically trained Indians possessing the required qualifications. They have so far been generally hard to find and the employer and employee have had difficulty in getting into touch with each other; but we believe that our visits and the relations we have established with employers of labour have removed many misunderstandings and have opened up many further opportunities for apprenticeship and employment. We feel convinced from the number of instances we have found of technically trained Indians occupying good positions in industrial concerns, that provided the man with a technical training is prepared to work, he has every chance of success in the future.

CHAPTER II.

TECHNICAL EDUCATION AND TECHNICAL INSTITUTIONS.

Definition of technical education on which recommendations are based.

16. The Simla Educational Conference of 1901 stated:

"That Technical Education may be defined as—

(*a*) The study of the scientific methods and principles underlying the practice of any handicraft, industry or profession.

(*b*) The application of those methods and principles to the practice of the handicraft, industry, or profession in question."

Existing so-called Technical Institutions and their faults.

17. The existing technical institutions will be dealt with in Part IV, but generally speaking there are a very large number of small so-called technical institutions established all over India, the present organization of which is unsatisfactory.

[2] It is the impression of many people in India that it is sufficient to get together a few tools and appliances regardless of the use to which they can be put for training purposes, to put up a laboratory for physics and chemistry of an inadequate character, and to put in charge of the establishment a man whose sole claim to this position lies in the fact that he has obtained a certificate from a similar institution in which the staff and equipment are only a grade or so above that of which he is put in charge; give him an inadequate staff paid little or no better than ordinary artisans and usually selected

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[1] See paragraphs 81, 101, 110, 123, 124, 135, 139, 144.

[2] See paragraph 43.

from private or family reasons, and you then have a type of institution which has been repeated over and over again during the last few years all over India.

The harm that such educational experiments have caused to technical education is incalculable and that they have been allowed to continue is an evidence more of the generosity of their supporters than of their knowledge of technical education.

If any real and lasting good is to be attained, and the antagonism which has been shown towards technically educated Indians is to be overcome, it is evident that these institutions must either be swept away entirely, reconstructed, or subordinated to the position of feeders for the technical institutions proper. Under control and adequately financed there is no doubt that many of them could carry out a good deal of preliminary training work.[1]

Objection to following Western methods.

18. The condition of Indian industries, the standard and character of work, and the opportunities for employment open to technically trained men are all of so different a character to Western conditions, that it is impossible to make any comparison between the type of education found necessary in Europe and America and that which is demanded in India. To follow on lines which are found necessary in England or America would not produce the type of technically educated man which our enquiry has shown there is a large demand for. Western methods of specialization are not yet common in this country, and there is little or no possibility of any student who has specialized in a particular branch of his profession finding any position in which that special knowledge can be applied. In proof of this we have found many instances of men who had been abroad to study some special subject, and had found it impossible to apply their special knowledge on their return to India, and had in consequence of lack of opportunity taken up some other line in life. The probable reason of failure may be that the opportunities for doing practical work abroad were non-existent[2] for theoretical knowledge alone is of no value.

Preliminary Education.

19. It must always be recognised that a satisfactory preliminary education, of the standard suitable to the grade the aspirant ultimately aims at, is an absolute essential for any scheme of technical education.[3]

The principles governing the more elementary stages of this preliminary education have been ably dealt with in Sir Edward Buck's report on Practical and Technical Education. This subject is meeting with the serious attention of the Educational Department and is beyond the scope of our enquiry.

20. The following extracts from the recommendations in respect of a higher stage of preparatory education, by the Committee appointed by the Institution of Civil Engineers to consider and report on the subject of the best methods of education and training for all classes of Engineers (1906) may be usefully quoted :—

"5. Instruction in Mathematics should be given by methods differing considerably from those usually adopted in the teaching of this subject merely as an intellectual exercise. The geometrical side of Mathematics should be fostered, and before they leave school boys should be conversant with the use of logarithms, and with at least the elements of trigonometry, including the solution of triangles. It is also of importance that instruction in practical arithmetic should be carried further than has been generally the case hitherto, with the object especially of encouraging the use of contracted methods and operations in mental arithmetic; and of encouraging also the expression of results with only such a degree of (numerical) precision as is consistent with the known degree of certainty of the data on which they are or may be supposed to be based.

"6. It is preferable that boys should attain at school a general knowledge of elementary Physics and Chemistry, or of what is sometimes called "Natural Philosophy," rather than they should pursue in detail some particular department of science.

"7. Special attention should be given to drawing; the instruction should include ordinary Geometrical Drawing with orthographic projection, Curve Drawing, Freehand Drawing, and Practical Mensuration.

"8. Work in the nature of handicraft, such as carpentry or turning, or elementary field-surveying, may be encouraged as a recreation but should not be required as a school exercise."

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[1] See paragraphs 178 to 185.

[2] See paragraph 176

[3] See paragraphs 100, 137.

CHAPTER III.

THE VARIOUS METHODS OF CARRYING OUT TECHNICAL EDUCATION AND THEIR VALUE TO INDIA.

Civil Engineering.

21. The opinion generally expressed was that the existing system of training in Engineering Colleges was the most suitable one for the requirements of India.[1]

Practical training, however, is most essential for every grade of the personnel of Civil Engineering, and is seldom or never at present obtainable except in the case of men who have secured guaranteed appointments under Government.

A very large percentage of the men turned out from Indian Engineering Colleges obtain employment under municipalities, district boards, railways, and contractors, and excellent material is often spoilt or damaged in its efficiency by want of practical training.[2] This can only be obtained in the various branches of the Public Works Department; and it is in our opinion likely that the cost to Government of granting a year's apprenticeship in practical work to every man passed out of an Engineering College would be amply repaid by the general benefit it would confer on the country at large professionally and financially. In nearly every case the ultimate employer of every grade of Civil Engineer is closely related to Government in some way, and from the point of view of general efficiency, Government must be a considerable gainer if these apprenticeships are introduced. Great care is, however, required in the selection of teachers. The system in force for the training of apprentice overseers passing out from the Civil Engineering College, Roorkee, is a satisfactory one and may be followed.

The type of institution for training in Civil Engineering

22. Engineering education of every grade should be concentrated when possible in large colleges where the lower classes can obtain the advantage of the traditions, ideals, moral training, and above all the supervision of a high grade competent staff which can only be met with in large institutions in India.

The manner in which civil engineering work is controlled in India differs largely from that which obtains in the West. In the West we have the consulting engineer or architect who is responsible for the engineering or architectural features of a work which is carried out by a "clerk of works." Overseers and sub-overseers do not exist. In India generally the engineer has to combine all these functions, the scattered nature of his work and the distances rendering necessary the overseer and sub-overseer to supervise labour and work. These men while not requiring any high theoretical knowledge, require a very sound training. This training requires expert supervision, which is usually only financially possible in the larger establishments where the scope for education must necessarily be of a wider character than is possible in smaller and less well equipped institutions.

Mechanical and Electrical Engineering.

23. For the training of men for these professions, which are very closely allied, the recognised methods are—

(*a*) Apprenticeship in works, theoretical education being carried on concurrently in special institutions, for day or night classes.

(*b*) "The sandwich system." In this system the practical and theoretical training is so arranged that the student spends six months in works alternating with six months in a college, which should be near his home, so that he may be thereby subject to good influences and affectionate surroundings.

(*c*) An apprenticeship in works followed by a training in a technical institute.

(*d*) A training in a technical institute followed by an apprenticeship in works.

Value of the various methods of Technical Education in Mechanical and Electrical Engineering to India.

24. We will now consider the value of these methods for the training of the various grades in the Mechanical and Electrical Engineering professions *for India.*

[1] See paragraphs 51, 112, 129.

[2] See paragraphs 129, 138.

25. (*a*) The High Grade Mechanical or Electrical Engineer.

[1] It is almost the universal opinion of the "employers" we have interviewed that there is at present no opening in India for men of this grade, or for an Indian with a "University type" of education in the professions under discussion. The openings for employment of men of this grade.

It must be remembered that it is the average man we are considering and not the exceptional. The latter man, whether "he becomes like the first Lord Armstrong an engineer by necessity or finds his way up from the humblest position to the highest ranks by sheer ability, will always be able to take care of himself."

Opportunities for the employment of such men may occur in time, when Indian capital comes forward on a large scale to finance industry, when India becomes a manufacturer of engines, machinery and electrical plant, when by education and heredity the character of Indian engineers becomes more reliable, full of energy, push, and adaptability, and when Indians have more confidence in each other and can know that that confidence will not be misplaced.

At present the existing Indians of this grade have mostly had their education in the West. Few, however, have had little or any opportunity for practical experience, and, on returning to India, they demand salaries, in many cases, higher than those for which a European can be engaged with the requisite theoretical qualifications, and, with what is far more important in India, a vast amount of practical experience, without which every technically trained man is useless. In other words, these men ask to be highly paid to acquire their practical experience.[2] We are, however, of the opinion that if a man of high education and social position will undergo the grind of the necessary practical training, and possesses the other necessary characteristics, he should, man for man, have an advantage in his endeavours to reach the higher positions in his profession over men of inferior class and education.

26. We are of the opinion from evidence gathered during our enquiry, that Indians, if possessing the necessary character, theoretical knowledge, and practical experience, have more than an equal chance of employment in India with Europeans.[3] The opportunities for the employment of Indians as compared with Europeans.

The question is well put in the following extract from a letter by the chairman of the Madras Chamber of Commerce :—

"The Chamber would point out that in industry there is no racial question, as such, whatever. If industrial managers can get any given work done as well by an Indian as by a European, the former if cheaper, as he always would be, would certainly get preferential employment. But commercial enterprises are not conducted as schools, and if the efficiency of any given man is not obvious, time is not wasted in finding out why he is not efficient but this work is given elsewhere even at a higher wage. Up to a point, the Indian is an excellent, cheap and reliable employee. Beyond it, he fails to come up to modern industrial requirements. The Chamber is not prepared to dogmatise as to the causes of that failure or as to the educational or other remedies possible for it, but the personal experience of several of its members in connection with many factories throughout India, leaves no practical room for doubt of the fact mentioned."[4]

The result of our enquiries, however, shows us that till the vital objections stated are remedied, there is no doubt that Indians cannot to any great extent replace Europeans in the higher positions of trust and responsibility.

The general method by which this grade of man will obtain his complete education, theoretical and practical, is closely allied to that which we will discuss in detail for the next grade, except that the former will have a much higher scientific training and the latter less science and more practice.

It should be noted that in the type of education and training recommended there is nothing to prevent an Indian of the highest social status or education rising to the highest post in the profession he has chosen, if he possesses the other necessary qualifications and characteristics.

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[1] See paragraphs 49, 50, 51, 57, 58, 60, 61, 73, 74, 75, 76, 99, 101, 107, 108, 110, 116, 117, 118, 119, 120, 122, 125, 135, 137, 140, 146, 148, 156.

[2] See paragraph 76.

[3] See paragraphs 51, 63, 66, 71, 75, 77.

[4] Letter to Secretary to Government, Revenue Department, Madras, dated the 4th July 1908.

27. (*b*) The Improver Grade.

The large opening for employment for men of this grade.

We find from enquiries[1] that there is a very large opening for the employment of Indians of this grade. The man required is one, who, after a good practical and theoretical education, is willing to take up an apprenticeship on a living wage, take off his coat and work with his hands on any job he may be put to, obey orders, and above all conform to workshop or factory hours. Provided these conditions are satisfactorily fulfilled, his race, creed or social position make no difference in the industrial world.

Employers of labour have universally stated, they are anxious to obtain such men, and will gladly give facilities for apprentices and pay them a living wage.

It is a noteworthy fact that in almost every case employers have stated that they are willing to give a living wage to technical apprentices. In many cases they have stated that they would not allow an unpaid man in their works. They are, and very rightly, not prepared to pay more to apprentices, however high their technical qualifications may be, till they have gained practical experience[2] in the mill or factory and proved their worth.

Appointments which are available in a greater or lesser degree for technically trained Indians.

28. Generally speaking, we find that in all large industrial concerns of any magnitude the controlling or managing body consists of—

1. The Manager.
2. The Assistant Manager.
3. The Head of Department.
4. The Assistant Head.
5. The Foreman.
6. The Assistant Foreman or Chargeman.

For all of these posts technical training is necessary to a greater or lesser degree. The possibility of technically trained Indians filling these posts is always existent, provided their knowledge and practical experience is of the required nature. In many instances in different parts of India, we have found these posts filled by technically trained Indians to the satisfaction of their employers.

Employers, however, generally state, that so far they have not met with such men.[3] They state that in most cases students from technical institutions will not work with their hands, will not observe factory hours, ask too high wages for learning their practical work and generally think they know everything.

The reasons that technically trained Indians have so far partially failed to meet the demand.

29. The reasons that technically trained Indians have so far partially failed to meet the demands of employers seem to be—

(*a*) Certain races in India are more fitted by nature for this class of work than others.[4] The prevalent opinion seems to be that certain races are not, on the average, naturally fitted for technical work. Their caste prejudices and necessity for religious observances are all against the possibility of successfully carrying out the necessarily rigid rules of workshop life. Though willing to work with their hands in technical institutions, they are mostly unwilling to do so when they enter the stern reality of the workshop and consider they need only supervise.

Employers state that men of certain races, if they have passed any University Examinations, are unfitted for practical work, and consider themselves above it.[5]

The Parsees, however, in this respect are very different, and Parsee graduates are willing to take up the humblest work to gain their

[1] See paragraphs 50, 51, 54, 55, 56, 57, 58, 60, 63, 70, 72, 74, 76, 77, 79, 81, 97, 98, 99, 101, 102, 103, 105, 107, 108, 109, 110, 111, 113, 114, 116, 117, 118, 119, 120, 121, 122, 123, 125, 139, 140, 142, 143, 144, 145, 146, 148, 149, 150, 151, 152, 154, 155, 156, 157, 158.

[2] For only exception see paragraph 159.

[3] See paragraphs 50, 51, 54, 55, 56, 57, 58, 60, 63, 74, 75, 76, 77, 79, 81, 102, 103, 108, 110, 111, 112, 113, 116, 119, 120, 125, 146, 148, 156.

[4] See paragraphs 199, 213, 224, 230, 234.

[5] "Technical education can be of no industrial value to men who are ashamed to use their own hands, neither can it benefit the manufacturers of this country if the student expects to join his work at 10 o'clock or four hours after factory work is in full swing." C. Simpson (Binny & Co. Madras).

practical experience in the same way the European has to do, and the Parsee graduate often turns out a first class man.

(*b*) Most technical institutions, up to date, have by force of circumstances, endeavoured to get posts for their students on leaving the institution and in most cases have thereby damned technical education in the eyes of employers.

It is the universal opinion of employers of labour in India, European and Indian, and a fact well known to the practical world at large that a man however carefully prepared in a technical institution, college, or university is utterly useless to an employer of labour till he has had practical experience.[1] He must in all cases begin at the lowest stage and work up gradually in time. The extent and diversity of this practical work depend on the grade or specialized industry aimed at. For a high grade engineer, it must be continued through the shop, the draftsman's office, and the commercial office ; for the improver it starts from the fitter's bench, the lathe, or switchboard, and probably ends in one department. There is great difficulty in India as in England in obtaining an all round apprenticeship experience. Nearly every workshop or factory specializes to a greater or lesser extent and in whatever department an apprentice enters to gain his practical experience, in that department he must be prepared to make his career, unless he is an exceptional man.

The responsibility of the authorities of technical institutions and the life which lies before a technical student.

30. The idea which is prevalent in the minds of most technically trained Indians that the successful completion of their college course fits them for one of the higher of these posts must be removed. The authorities responsible for technical education must make it clear to their students that they are totally unfit for any position of authority on leaving the institute, that they must first of all be subjected to discipline and learn under practical conditions the details of the work which they eventually hope to supervise, otherwise there will always be a large number of men who will fail to go further than the end of their college course. From this point the student must be prepared to go into the works, mill, or factory with the full knowledge that he will meet with serious opposition from men socially and educationally his inferiors, but who, because they have worked themselves up from the point at which he is now starting, are of much greater value to their employer than he may be at present.

After his training he must still understand that he is not a necessity until he has proved that he can do something better or more economically than the man he hopes to supersede.

Results of the enquiry.

31. Our enquiry has shown that the only way in which the employment of technically trained Indians can become more general is for the authorities of the institution in which they have been educated to insist on a satisfactory apprenticeship of at least two years and to withhold all certificates or diplomas until its completion. We find that nearly every employer of labour whom we have interviewed will co-operate in such a scheme, but will not employ a technically trained Indian without[2] such apprenticeship.

The higher appointments can therefore only be given to men who are prepared to start under these conditions and to take off their coats and work their way up. There is every reason to believe that if this line of conduct had been more generally followed in the past a far greater number of Indians would now be occupying official positions in industrial concerns than is now the case. Where possible, it may be advantageous for the institute to hold an examination at the conclusion of the apprenticeship to ensure that all theoretical knowledge has not been forgotten.

No institution alone can give a training which will fit a man for any of the posts enumerated, and it has been generally admitted that the higher engineering courses now being taken up at some of the Universities will not do so either,

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[1] Note from Paper read at the Association of Technical Institutions, February 20th, 1912.

"But a college training cannot completely equip the technical expert. It cannot teach works' methods of dealing with bulk and of developing speed of output, but it *can* give him a full scientific and technical knowledge of his trade. It cannot teach him the control of men, but it *can* develop the self-reliance, tact, firmness, dependableness, and in a word *character* on which control is largely based and which it should be the chief object of all education to build up."

See paragraphs 61, 66, 68, 69, 70, 71, 77, 79, 97, 98, 99, 101, 102, 103, 105, 107, 108, 110, 111, 112, 113, 114, 116, 117, 118, 119, 121, 123, 124, 125, 138, 139, 142, 143, 145, 146, 148, 149, 151.

[2] See references to paragraph 27. "During workshop training they should keep the regular working hours, should be treated like ordinary apprentices, be subject to discipline and be paid wages." Report of Committee upon the best methods of education and training for all classes of engineers, 1906.

but that they will probably produce a man who has less chance of success than his technically educated and more practical but less scientific brother.

The promise of the future.

32. It must not be thought for a moment that all students from technical institutions have proved failures. Where the rule of a two years' apprenticeship after the college course, before any certificate is granted, has been tried, we found during our enquiry that on the whole, the reports on the apprentices were good.[1] We have found many students from Technical Institutes in highly paid and responsible positions,[2] but these have been in every case men who on leaving their institutions have recognised the necessity for working hard with their hands and gaining their experience in a subordinate position with a low salary at starting. We do not feel in the least discouraged by the results of our enquiries. We recognise the formidable difficulties that technical education has had, and will have to encounter, but given time and *practical* guidance we are sure the average of success among technically trained Indians will be as great, if not greater, than among those turned out in England, and this opinion is confirmed by the number of successful instances we have met with.

Technical education in England, even in the present day, is not an unqualified success, and in the early days there were repeated failures and disappointments. We are of opinion that there is comparatively little or no complaint so far to make against its general success in India considering the difficulties which have had to be encountered.

Though the men at present trained in the various institutions in India have not completely met the demands of employers, there appears to be no complaint which can be seriously considered as to their knowledge and ability, but the general opinion seems to be that, in prompt and regular attendance, steady application to work, constant care and supervision when in charge of delicate machinery, the average Indian is unreliable.

As already stated, we have found examples to the contrary, of technically trained Indians who have been content to commence in a subordinate position and from that to work themselves up step by step till they are now in positions of responsibility and in receipt of salaries in proportion, and we are forced to believe it is not the education or training which is at fault but the average material which is weak. The general disinclination for hard physical labour on the part of the average educated Indian is the chief cause of failure in the technical education of the Indian of to-day, and its only panacea is the strict insistence on the test of practical apprenticeship before any certificates are granted, and the resolute weeding out of lazy and unsuitable material.

The training of Mechanics.

33. The question of the training of mechanics is considered in Chapter XV, page 83.

CHAPTER IV.

ANALYSIS OF THE SUITABILITY OF THE VARIOUS METHODS OF TRAINING FOR THE MEN AT PRESENT IN DEMAND IN INDIA.

The advantages of system.

34. (*a*) Apprenticeship in works, theoretical education being carried on concurrently in special institutions for day or night classes, night schools and science colleges.

A certain number of the gentlemen interviewed were in favour of this method.[3] It has undoubtedly produced excellent results in England, and in a

[1] See paragraphs 52, 58, 71, 72, 113, 142, 143, 144, 147, 151, 152.

[2] See paragraphs 58, 76, 93, 125, 135, 155, 158.

[3] See paragraphs 110, 113, 135.

paper read before the Royal Statistical Society it is stated: "In England a direct investigation was made in a well-known manufacturing town, from which it appeared that 60 per cent. of the heads of private manufacturing businesses owed their position to their own private efforts and they had begun life in the lower economic ranks. In a cotton-spinning district it was found that 15 per cent. of the managing directors, 42 per cent. of the mill managers and 67 per cent. of the assistant managers come from the working class families, or families with incomes about the same as those earned by the operative classes."

These men were educated under this method.

35. Employers interviewed however recognised that the conditions in England were vastly different to those in India. The unsuitability of the system to Indian conditions.

England has an old-established industrial civilization, populous cities teeming with industries. India is a country of enormous distances, with few established industries. In England there are numerous technical institutions and science colleges in every town, the expenses of maintaining which are enormous compared with any in India. The Manchester Technical Institute alone cost £365,000 at the start which is more than the cost of all the institutes in India collectively.

Further after a long day's work in the Indian climate, the Indian student is physically incapable of doing any serious work in a night school.[1]

36. In confirmation of this opinion it may be mentioned that some years ago the Victoria Jubilee Technical Institute, Bombay, started night classes for apprentices and workmen employed in the various mills, workshops, etc. Every effort was made to render these classes attractive and efficient; it was, however, found that a very small number of those who attended were capable of taking any intelligent interest in the subject and the majority were unfit to carry on any continued mental effort. The classes were ultimately discontinued owing to lack of students. Night schools.

This method may therefore be dismissed as unsuited to the training of the "Improver" grade in India.

37. (*b*) The "Sandwich System."

Institutes in India can only be few and far between and owing to the enormous distances this method seems unsuited to Indian requirements. The unsuitability of this system to Indian conditions.

38. (*c*) An apprenticeship in works followed by a training in a technical institute.[2]

The main difficulties of this system are that the ordinary aspirant to a technical career is not in a position to obtain an apprenticeship in works; after a break of three or four years in his education he will find great difficulty in settling down to organised instruction in a technical institute; after a year or two of apprenticeship he will be drawing wages which he will be either loth to give up, or he will be financially unable to attend a technical institute course; and further by attending a technical institute he loses touch with the opening he has made for himself in the workshop he has attended. The difficulties of carrying out this system in India.

39. (*d*) A training in a technical institute followed by an apprenticeship in works.

From our enquiries we find that this system, though in no way perfect, is generally regarded as the most suitable to the needs of India. The suitability of this system to Indian conditions.

The institute is in a better position than the student to find a suitable apprenticeship, it can train him in methods of practical work, it can guide and direct during his apprenticeship, and finally assist him in obtaining employment. In addition, during his course at the institute it can be determined with certainty if he is fitted to carry on the profession he has selected.

Under this system no certificate of any description should be granted by an institute till the student has satisfactorily completed his apprenticeship and the final examination of his institution, which in some cases will be necessary in addition.

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[1] See paragraphs 110, 116, 119, 149.

[2] See paragraph 113.

CHAPTER V.

THE TYPE OF MAN, EDUCATION, AND INSTITUTION REQUIRED.

The type of man required.

40. The type of man that is wanted is one who has been grounded both practically and theoretically in the profession he has chosen, a very large amount of stress being laid on the practical, and who is prepared to go out and work in the most subordinate grade and gradually work himself up into a position of trust and authority.[1]

Character of education needed.

41. It may be stated that the technically educated man this country needs as shown by our enquiry must have training and education of such a character that he can make himself useful and later *indispensable* [2] to his employer.

This education should be—

(1) essentially practical and covering as wide a ground as possible;
(2) of such a character that it is capable of being applied commercially;
(3) the theoretical portion should be complete enough to enable the student to reason for himself in a difficulty and to act on his own initiative in case of emergency;
(4) the working conditions should be so exacting that the transition from educational to practical life is not so great as to cause a desire to slack work.[3]

In addition it appears, if the demands of employers are to be met, that a greater amount of practical work should be required from the student,[4] and that for some period after his training in the institute, some *controi*[5] should be exercised to ensure that he is doing work under such practical conditions that he must in the long run make himself, what is absolutely necessary for success, *indispensable*[2] to his employer. It must be recognised that it is the work a technically trained student can do and not his general knowledge for which an employer is prepared to pay.

Type of Education needed.

42. The type of education required in our opinion need not be of such a high scientific character as is considered necessary in England, America or Germany. There is a distinct tendency towards the introduction of this danger, by some educational officers engaged in technical education. That it is not altogether unknown in England may be gathered from the following remarks of Sir William White, late Chief Constructor to the Admiralty, at the Conference at the Institution of Civil Engineers, 1911 :—

"He stood among those who thought that the danger of excessive devotion to the scientific side was very considerable in these days, and that the Institution was doing well in recalling attention to the absolute necessity of a thorough practical training."

The following remarks[6] of Sir John Hewett may be quoted as bearing on this subject:—

"I will confine myself on this occasion to sounding a warning note as to the danger of a defect which seems likely to creep into the systems of technical and industrial education in this country. It is this, that we may look to too much theory instead of practice. My firm conviction is that India is not likely to advance very rapidly on the path of industrial progress, unless people will realize more than they do at present the value of the most empirical form of practical training. The best technical work is done by those who learn the theory after the practice. One sees too much in this country of people who hope by a study of theoretical science to develop into efficient managers of practical concerns."

Type of Institution in which such training can be carried out.

43. The type of institution in which such an education can be successfully carried out would preferably be one in which more than one professional subject was undertaken. As much of the elementary theoretical work is common the saving in staff will be obvious, and the efficiency greater. In an institution in which a large number of students can be dealt with it is possible to have a specialist in each important subject, and this is not possible in a small institution for financial reasons.

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[1] See paragraph 27.
[2] See paragraphs 139, 151.
[3] See paragraphs 110, 125, 135, 142.
[4] See paragraphs 58, 107.
[5] See paragraphs 178 to 185.
[6] Budget Speech, 29th March 1912.

It would appear, therefore, that for reasons of efficiency and economy it would be better to develop the existing successful institutions than to increase the number of smaller ones in which the standard must necessarily be lower.

The distances in India are, however, very great, and smaller institutes must exist, in response to local demands, but they should only be permitted to exist or be established, if they are adequately financially endowed, properly equipped with staff and apparatus and are placed under proper control as regards their courses and certificates.

The Staff of Technical Institution.

44. Unfortunately the governing bodies of many technical institutions have not generally recognised the fact, that technical education for this country, if it is to be successful, must be in the hands of practical men ; and it should be clearly understood that only those men who have had a long practical experience and good scientific and commercial training are really capable of sound technical educational work. Such teachers must still keep in touch with the various industries, keep fully up-to-date in whatever is being done in their line of work, and if possible be allowed to take up consulting and advisory work as opportunity offers. If this last suggestion were permitted to a greater extent, the staffs of educational institutions and the managers and foremen of industrial works would be brought into closer contact and a more sympathetic feeling would be brought about between the employer and the technically trained Indian than is at present the case.

It is hoped the authorities will recognize that a three years' training in a technical institute in this country, although it may be the best obtainable here, coupled with a three years' cram for a diploma at one of the English institutions or American colleges will not fit any man to take up a position of any responsibility in the technical education that India needs to-day.

CHAPTER VI.

THE CO-ORDINATION OF THE RELATIONS BETWEEN INSTITUTES AND EMPLOYERS OF LABOUR AND THE ESTABLISHMENT OF AN EMPLOYMENT BUREAU FOR TECHNICALLY TRAINED INDIANS.

The co-ordination of the relations between institutions and employers of labour, and appointment of an officer to continue the work.

45. We are strongly of opinion that our tour round India and the interviews we have had with the proprietors and managers of industrial concerns, mills and workshops has resulted in bringing into much closer touch the employers of labour and technical education. A large amount of good has been achieved and the foundation laid for a much more sympathetic treatment of the technically trained Indian ; but if this sympathy is to be of a lasting character and the cordial relations which have been established are to continue, it becomes necessary to consider how and by what means these relations can be maintained.

In our opinion much of the good that has been done will not be of a permanent character, and the sympathy and promises of support for the technically educated Indian will not be taken advantage of unless some means are devised to continue the good relations now existing as the result of our enquiry.

To have a lasting effect we feel assured that constant touch between the educational authorities and the employers must be maintained, constant observation of the student while undergoing his apprenticeship will be necessary, and, above all, one central controlling authority for all India should be appointed, who will see that the recommendations now laid down are established and maintained.

The staffs of the technical institutions cannot do this work even if the time were at their disposal, nor, for obvious reasons, can the controlling or managing bodies of educational institutions. The Directors of Public Instruction or Directors of Industries, loaded up with their own duties as they are, are neither in a position to undertake the work, nor in touch with the practical and commercial requirements which are necessary to make for success.

In support of this the opinion of Sir E. C. Buck, K.C.S.I., may be quoted.[1]

It appears necessary to suggest the appointment of an officer whose duty it will be to see that technical education is carried out on the lines proposed in this report, to continue the relations we have established, and to extend and develop them as opportunity offers.

Establishment of an Employment Bureau, and qualifications of the proposed officer.

46. We consider that this officer should be attached to the Government of India and report to it on the working of technical education, and that he should also act as inspector and adviser for the various Provincial Governments.

He should maintain a register of the various works or factories in which training of the requisite standard can be obtained and arrange with the governing authorities of Institutions for the apprenticeship of their students, informing them of the various new opportunities for employment which may from time to time offer. He should also establish an employment bureau to assist obtaining employment for students who have completed their apprenticeship.

For the following reasons we do not consider that this work can be carried out successfully if an independent authority is appointed for each province. The employment of the technically trained Indian is not a provincial but a general question and can only be dealt with successfully by the one central authority who will not recognise any difference of race, caste or creed, but insist on a fair opportunity being given to every apprentice.

It must be admitted that in certain of the provinces of India the facilities for obtaining a complete practical training exist to a far greater degree than in others, and certain provinces must send their apprentices to the larger industrial centres for training. If it is left to a provincial authority to exercise control these facilities would simply be reserved for local apprenticeships to the exclusion of students from provinces in which the facilities for training do not exist, co-ordination of the work, which is so essential for success, would not exist and an undesirable competition would be established.

To ensure that employers of every grade will continue to look upon the scheme with a benevolent eye and sustained interest it will require for this post a man of good social position, broad views, a sound knowledge of the requirements of the country, both commercially and technically, and of such training and knowledge of affairs of Indian industrial life that he can meet and discuss technical education with all classes and grades of industrial authority with certainty.

We consider the appointment of such an officer a very necessary part of the scheme for improving the technical education of India and for extending the sphere of employment for which the technically educated Indian is fitted.

CHAPTER VII.

GENERAL RECOMMENDATIONS.

Summary.

47. As already stated in paragraph 15 the result of our enquiries shows that there is an almost universal demand among employers of labour for technically trained Indians who comply with the conditions stated in paragraph 27 (and references). To fulfil these conditions a practical apprenticeship is indispensable and that the facilities for obtaining this apprenticeship will be readily afforded in sufficient numbers is evident from the promises of support detailed in Part II. To keep this whole system working satisfactorily will be the duty of the controlling authority recommended in paragraph 45.

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[1] "The educational officers, however able and accomplished they may be, have themselves had no practical training, are not brought by their profession into contact with industrial occupations, possess no technical knowledge, are naturally deficient in commercial aptitude, and may sometimes have a professional tendency to give to literary instruction too prominent a position in the industrial school. Nor have they themselves (oppressed by work as they already are) any desire to become entangled in industrial schemes which would interfere with their legitimate duties."

48. The following general recommendations are based on our enquiry :— General recommendations.

(1) The existing system of training for the Civil Engineering profession in central colleges is the most suitable one for the requirements of India. Paragraphs 21 and 22.

(2) Apprenticeships for one year on practical work in the Public Works Department should be granted, if possible, to every student passing out of a Civil Engineering College. Paragraph 21.

(3) There is practically no opening at present for the employment of high grade mechanical or electrical engineers whose education is mostly of a theoretical character. Paragraph 25.

(4) There is a very large opening for the employment of men in mechanical and electrical engineering, who after training in a properly equipped Institute, are willing to gain their practical experience by apprenticeship on a living wage, work with their hands, and observe factory hours and rules. This employment is open to Indians of every caste or creed, grade of social position or education, provided these conditions are observed; and the height to which they can rise depends on their individual characteristics. Paragraphs 27 to 31.

(5) The best method of training men in mechanical and electrical engineering to meet the existing demand is by a course at a well equipped Institute, followed by an apprenticeship in works. Institutes should not grant any certificates till this apprenticeship is satisfactorily completed. Paragraph 39.

(6) The education given in the Institute should be essentially practical: be capable of being applied commercially, and not of such a high scientific character as is often considered necessary in the West. Paragraphs 41 and 42.

(7) Large mechanical and electrical Institutes are, at present, only necessary in those provinces in which industrial development is well advanced. Minor institutes should be properly endowed, equipped with adequate staff and apparatus, and placed under proper control as regards their courses and certificates. Paragraph 43.

(8) The staff of all Institutes should be carefully selected, and consist of men with the necessary theoretical attainments and extensive practical experience. To keep in touch with the various industries, the staff should be permitted to take up consulting and advisory work as opportunity offers. Paragraph 44.

(9) The scheme recommended for technical education for the mining industry is detailed in paragraph 293.

(10) Apprenticeships after a course at an Institute as detailed in recommendations 4 and 5 are equally necessary for technical education in the textile industry; in which the courses in spinning and weaving should be separate ones. Paragraphs 99, 110, 116, 118, 122, 139, 218.

(11) Afternoon classes for textile jobbers and mistris should, if possible, be instituted in suitable centres if a satisfactory demand exists, to give practical demonstrations in the vernacular in the theoretical side of their work. Paragraph 218.

(12) Arrangements should be made for the permanent co-ordination of the relations between institutions and employers of labour by the appointment of a controlling officer, and the establishment of an employment bureau. Paragraphs 45 and 46.

Special recommendations on subjects closely connected with the object of our enquiry will be found in Part III.

Detailed suggestions for adjusting the facilities for technical education existing in the various provinces to meet the demands of employers will be found in Part IV.

PART II.

Brief Accounts of Interviews with Employers of Labour and the Opinions Expressed.

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Acting Superintendent of Industries, Bengal.

49. Our first visit was to Mr. Everett, the Acting Superintendent of Industries, Bengal, who was for some years a Professor of Sibpur College and who was associated with us in our enquiries. We discussed the general aspect of educational supply and demand in Calcutta, particularly with reference to the education at the Sibpur Engineering College. We also discussed at considerable length the type of man for whom there is at present a demand, and also whether it would be necessary to hold advanced courses in mechanical and electrical engineering.

Mr. Everett's opinion was that such courses are not necessary at present, there being few openings for men of this class. He also thought that some alteration was necessary in the present courses at Sibpur, though he considered that the new overseer courses are a great improvement on the old. So far as he knew there was at present some difficulty in getting suitable posts for Sibpur students except those of the overseer classes, who were in demand.

Note by Mr. W. H. Everett.

At the outset I should explain that my permanent appointment is Professor of Mechanical and Electrical Engineering at Sibpur College, but that owing to long leave followed by transfer I have been away from there for the past two years.

The training in electrical engineering has been almost entirely confined to the apprentice (or subordinate) side of the college. Students in this branch first had to pass through the ordinary four years' course for Public Works Department overseer students, and then specialise entirely in electrical work for some 15 months. In the first four years they spent much time in the various mechanical workshops of the college, and also took such subjects as steam engine and applied mechanics, all of which helped them later: but far too much of their time was devoted to civil engineering and other subjects of little subsequent use to them. Also the course was too long. Yet I have had no difficulty in finding employment for all, except a few whom I could not recommend for electrical posts. Europeans have usually received a starting pay of from ₹80 to ₹150 and Indians of from ₹60 to ₹120, and many of them have had the highest commendation from their employers. One Indian, who left college seven or eight years ago, is now getting ₹400 a month, and the record of the work he has done and the testimonials he holds from English engineers are so good that I have felt justified in proposing him for full membership of the London Inst. of Electrical Engineers, though he is only just over 30 years of age.

Several others are getting high pay, and no employer has ever complained to me that he is dissatisfied with any of my passed students.

However, as I have said above, the course had obvious drawbacks, which I pointed out long ago, and eventually it was condemned on my recommendation by the Principal some five years ago. When the Joint Technical Examination Board was formed, the opportunity was taken to arrange for a bifurcated course, the first two years being general and the last two specialising in mechanical and electrical engineering. Owing to various obstacles and delays this new course is only now being introduced. The threatened removal of the college to Ranchi, which has been impending for some seven years' has tended to prevent improvements and changes. Obviously two or three years' notice had to be given before the new course could actually be begun.

Few Sibpur students have taken to mechanical engineering. One reason is that the old course was unsuitable, as it was for electrical men. As compared with electrical work, doubtless they found that they could get better pay in that line and saw better prospects, and probably liked the work better.

The present staff at Sibpur has such a preponderance of men trained in civil engineering that other branches are at a disadvantage. After years of waiting, I have only now got an assistant, apart from the workshop foremen instructors. There is still no man qualified to take machine drawing. But, in view of the fresh start which will be made at the proposed Technical Institute in Calcutta, it is unnecessary to dwell on such points.

I may mention that in several cases students have refused to accept promising posts which I was able to offer them, on the grounds that the initial pay, say ₹40, was insufficient, although I pointed out that the prospects were the main thing.

With regard to the new bifurcated course, I may add that, though it is a great improvement on the old course, I do not think it perfect for my subjects. There is still too much civil engineering, in my opinion, especially in the first two years; surveying ought to be cut out, and the drawing ought to be mechanical and electrical. The course represents the average opinion of the members of the Technical Examination Board when first constituted.

At Sibpur we have received applications from time to time for mechanical draftsmen on an initial pay of about ₹40, and such men we are unable to train under present arrangements and staff. This demand ought to be met, and I hope it will be in the new institute.

As regards the plant at the college some of it was installed, under the supervision of an outside engineer, a few years before I came to India. All the rest has been specified for by me and installed under my supervision by the college staff and students. In the running of plant the students get an excellent training, both with direct and alternating machinery, including testing of engines and boilers. They have to keep a regular log daily, and work out the costs for each month. I know of no college in England where such a full training is given in actual running, the plant being in actual use for power and light and about 12 hours daily. The students also get much experience in wiring; and several 1½ H.-P. motors have been made by them. They go through a simple course of electrical testing, as well as lectures and class work. The tests are such as they are likely actually to require in practice.

At first the numbers taken in the electrical department were very small; in the five years from 1897 (when the department was started) to 1901, the total numbers shown in the list are 12 Europeans and 2 Indians, an average of under three per annum. In the three years 1906 to 1908, the last in the printed list, the numbers are 21 Europeans and 24 Indians, an average of 15 per annum.

Messrs. Bird & Co.

50. The senior partner, Sir Ernest Cable, gave us an interview at which his partner Mr. Strain was also present. Both these gentlemen gave their views with regard to technical education and the standard demanded, and were strongly of opinion that there were no openings for highly-trained Indians in mechanical and electrical engineering; but there were plenty of opportunities for men with a good sound practical training, and some theoretical knowledge

(referred to in this report as the "Improver Class"). Sir Ernest very much deprecated the idea of training men on lines which unfitted them for practical work, *i.e.*, the engineering course of an university character. He was certain that such men could not obtain posts, and also that such training unfitted them for practical work. He had several such men employed at various times and in all cases the practical training was absent, and the men would not, or could not, carry out the work they were expected to do. These remarks apply only to the mechanical engineering students and not to those of the civil engineering classes educated at Roorkee and Sibpur. Sir Ernest suggested we should visit some of his mills and coal mines and obtain the opinion of those actually in charge. He kindly made arrangements for us to do this. Mr. Strain drew special attention to the difficulty of employing Indians in posts of trust in mills in Calcutta, where chiefly Europeans were employed. These men were very clannish, and it would be difficult for an Indian to retain his position, if appointed. A college-trained Bengalee, in most instances, considered himself a gentleman whose hands should not be soiled by actual work, and in the rough-and-tumble of mill life there was no room for such men. Sir Ernest Cable expressed his opinion that firms which were on the Government contract list should be asked to take apprentices in return for the work given to them. He deprecated sending Indians to Europe on State scholarships, and thought this money would be much more wisely spent in paying apprenticeship premiums for technically-educated Indians.

Messrs. Martin & Co.

51. We had an interview with Sir R. Mookerjee. In his opinion Sibpur and Roorkee were jointly turning out a really good type of civil engineer, though in his opinion the Roorkee training was of a more practical type, and turned out a very good man. These institutions were probably able to supply all the present demand of this character. He had something like 16 of these men at present in his employ, and they were in receipt of wages varying from ₹200 to ₹450 a month plus allowances and bonus for meritorious work. He would be glad to get mechanical and electrical engineers with a similar standard of training, but up to the present had not been able to find such men, and would gladly welcome and give a trial to any Indians who had a really practical training in these subjects and who were not afraid of work. He was prepared to give a trial to three or four apprentices. In his opinion the standard of education in mechanical and electrical engineering up to the "Improver Class" does not need extending, but should be of a very practical nature. He did not think very high training was required as men so trained would not obtain appointments, and he, from a commercial point of view, would much prefer an European to an Indian of similar qualifications when a man with a higher training was wanted. He expressed similar views to Sir Ernest Cable with regard to Government scholarships in Europe.

Government Telegraph Workshops, Alipur.

52. We have had an interview with Mr. E. Thompson, Superintendent, who showed us the works. Several mechanical apprentice students from Roorkee were working there, and one who has served his term now supervises the instrument-testing on ₹180 per month. The superintendent stated that all were most useful, and he was entirely satisfied with the standard, and did not consider that any higher education was needed. He said there were few appointments available at Alipur, but that he was glad to continue his present practice of taking a certain number of students from Roorkee for their two years' apprenticeship. He has no students from Sibpur.

Civil Engineering College, Sibpur.

53. We were shown round by the acting Principal, Mr. W. Tate, and had a long discussion with him, Mr. S. K. Dutta, Officiating Professor of Mechanical and Electrical Engineering, and Mr. J. V. Francis, Superintendent of the

apprentice department, regarding the openings for employment for Indian students who receive their technical education at the Civil Engineering College.

Mr. Heaton, the Principal, gave us the following note on his return to Calcutta:—

The main work of the College is training for civil engineering; mechanical and electrical engineering have been and are being developed according to necessity as shown by the demand.

There are successful artisan classes of long standing in the workshop and about 25 to 30 are now on the rolls. These artisans are eagerly snapped up by employers when they have completed their training.

Classes in dyeing have recently been started and no trained students have yet been turned out.

There are also classes for training students in mining surveying, and engineering. The course lasts two years, the admission standard being the sub-overseer examination. About six students qualify yearly, and hitherto there has been no difficulty in finding employment, it being easier to place Europeans than Indians.

With reference to the students trained in mechanical and electrical engineering at the college, it was pointed out that there is at present no special recognised course of theoretical training in mechanical and electrical engineering at the college, but that students are selected for training in the college power-house and electric department after the final overseer examination; that they there receive a 16 months' course of practical training on the maintenance of the college installation, which is accompanied by a course of lectures and laboratory work. The number of students that go through this course is on the average 12 yearly.

There is no difficulty in obtaining suitable employment for Europeans, but it is not quite so easy for Indian students. Reliable students can always be provided with good posts. After the selection for the electrical department the remaining students who pass the overseer examinations are placed for the 16 months of practical training in the college workshops, where they are put to all sorts of work. Practically all of these eventually get employment in civil engineering.

The training in the apprentice department has hitherto been mixed and of a general character—civil and mechanical.

New specialising courses of (A) civil engineering and (B) mechanical and electrical engineering have been sanctioned and will be introduced in April 1912.

The admission qualification is the sub-overseer standard; and the special courses will last two years to be followed by one year's practical training.

HIGHER TECHNICAL COURSE.—Civil engineers are trained for the B.E. degree of the Calcutta University, and on passing are placed on a year's practical training.

MECHANICAL AND ELECTRICAL ENGINEERING.—The opening of a class teaching the B.E. course in mechanical and electrical engineering has been under consideration.

On the part of students there seems to be a demand for such a class, and their practical training can be arranged for with firms of repute, as has been ascertained by corresponding.

The doubt is, whether they would find suitable employment, and would not spoil the market for the students we already train.

MINING.—It has been proposed to start a course of training for the B.E. degree in mining with a view of obviating the necessity of providing scholarships tenable in England.

Ishapur Gun Factory.

54. We had an interview with Colonel Foote, Superintendent, who stated he would be quite pleased to take some apprentices of the "Improver Class." The men he chiefly required were mechanically trained men, though he would have a few posts in his power-house. The work required was of a very accurate nature,

and at present he had to train his own men. He would perfer men who had been practically trained in technical colleges.

Colonel Foote stated that " to make men worthy of a certificate they should be apprenticed for at least five years in a good shop. A less period will not give them sufficient technical skill, and I find that without this they are useless as supervisors. For my supervision, I take men who are good enough to make gauges, train them to make a component, setting up the machines for themselves, and then set them to train others and make them section hands or line mistries as we call them."

George Henderson & Co.

55. In the course of conversation with Mr. J. Shorrock, he stated that there were openings in tea gardens for a generally useful trained mechanical overseer, but up to the present he had been unable to obtain the services of reliable Indians.

Messrs. Kilburn & Co. and Russa Engineering Works.

56. The managing agents, Messrs. Kilburn & Co., and the works manager, Mr. Aldersmith, were all interviewed and detailed to us the class of men they could find employment for. We were shown over their workshops, which, though small, had a remarkably up-to-date equipment, and found that they had openings for technically-trained men of the "Improver Class," but not for more highly educated men. They were prepared to take some apprentices each year, but would, if possible to get them, prefer up-country men to local men. They were specially interested in technical training for the mining industry and asked us to visit their mine managers, when we went to the mine fields. Owing to their kindness we were able to be present at the annual dinner of the Mining Association, where we heard many expressions of opinion regarding the character of technical education required for the mining industry.

Messrs. Octavius Steel & Co.

57. We had a long discussion with the general manager and managing engineer. They pointed out to us the difficulties they had experienced with students trained at Sibpur, and were quite agreeable to take some apprentices of the "Improver Class," both in mechanical and electrical departments, if they were properly trained. They would gladly welcome such men, as they would be relieved of the necessity of doing all the preliminary training, which had to be done before men became useful. Their opinion was, that no openings yet existed for the highly trained Indian, and they would not employ such a man, the reason given being that he could not, as a rule, be trusted in times of emergency or danger. There were also openings for technically-trained salesmen for managing branches of their business.

Messrs. Osler & Co.

58. We interviewed Mr. Robins, the manager, and found he had employed apprentices both from Sibpur, Roorkee and Bombay, who had in the majority of instances done quite well. He had at present some six or seven technically-trained men from the above mentioned colleges, who were in receipt of salaries from ₹100 to ₹400 a month. His opinion was that although technically-trained Indians were exceedingly useful up to a certain point, it would not be possible to find higher posts for Indians at present. He did not consider from his experience of Indian students, which was large, that any more advanced education was needed. He thought if possible it should be made more practical. He was still prepared to take Indian students, whenever vacancies occurred. This firm have been in the habit of charging apprentices a premium of ₹250, the idea being to make certain that the apprentices really meant to stick to their work: but Mr. Robins stated that if the apprentice scheme (which he considered the

only one possible) was generally introduced and accepted by firms and workshops, his firm would be prepared to waive the demand for a premium.

Messrs. Balmer, Lawrie & Co.

59. We interviewed Mr. Lawrie who was definite in his opinion that the training of the students at Sibpur in mechanical and electrical engineering had not been of the required character. He had had experience of these men, and had not found them satisfactory. He preferred to train his own men for the junior posts and those of any magnitude were occupied by Europeans. He was not at all keen on taking technically trained men as apprentices.

Messrs. Turner, Morrison & Co.

60. We interviewed the senior partner, managing engineers and chemist. They had all found great difficulty in securing the type of man who would make himself useful. They had many openings occurring, and would be glad to give any technically-trained Indian a splendid opportunity, if he was of the right sort. They had at present several openings for men, but did not know where to go to get the right stamp. The men they had had from Sibpur proved quite unfit, and they did not want any more of them. They were prepared to take apprentices in their engineering department on the lines proposed for the "Improver" class, and would also give employment to chemists trained in applied chemistry. Their opinion was that at present no openings were available for the highly educated man. They would prefer the man of moderate technical education and would train him for their requirements during his apprenticeship.

Messrs. D. B. Mehta & Co.

61. We interviewed Mr. R. D. Mehta who stated that in his cotton mill he could not offer employment in any responsible position to any Indian fresh from a technical school or college unless he possesses the necessary experience which can only be acquired by working in a mill for some time. He insisted on some years of practical work with all heads of departments, and considered that an advanced technical education without practical experience was no qualification for employment in mills in responsible positions; at present good spinners, carders, and weavers could be had from Bombay.

Mr. J. G Cumming, I.C.S., Bengal.

62. Mr. Cumming gave us much information which he had obtained on visiting the various industrial centres of the Presidency, when conducting the industrial survey of Bengal.

Mr. Cumming welcomed the proposal that the curriculum at the engineering colleges should be altered so as to differentiate between the training of those who were intended to be only subordinates and of those who were preparing for higher posts; and that he was beginning to have doubts about the advantage of the State technical scholarships, owing to the failure of the scholars to obtain suitable employment on their return to India.

Bengal-Nagpur Railway Loco. Works.

63. We visited the Bengal-Nagpur Railway Shops at Khargpur and were received by Mr. Bailey, the chief mechanical engineer, who had invited all his staff to meet at his bungalow. We found they had a complete system for training their own men, including an apprentice home for Europeans, and classes in the necessary technical subjects both for Europeans and Indians. Their system appeared to be successful, and it is doubtful if any educational institute could better their scheme under the conditions which prevail at Khargpur. The classes are controlled by Mr. Harnett, the assistant engineer,

who also did much of the teaching work. We were shown round the schools and workshops, and interviewed some of the apprentices who had received their training at Khargpur. We found them all carrying out good work, and the conditions under which they are trained are excellent. Notwithstanding that his own arrangements were meeting the wants of his workshops, Mr. Bailey stated he was quite prepared to assist any really efficient scheme of technical training for Indians by taking a certain number of apprentices of the " Improver Class " into his shops.

Bengal-Nagpur Railway.

64. We visited Mr. Jellett, the chief engineer, Bengal-Nagpur Railway, and had a long discussion both with him and the signal engineer. The manager was unfortunately absent from Calcutta. Their great want appeared to be trained men for permanent-way inspectors, and they were prepared to take Indians for this purpose, provided they were suitably trained. They would also be glad to take men in the electrical department for block signal work and at present could engage eight or ten men with the proper training. They had had many men from Sibpur at various times, but had not found them satisfactory. They were unanimous in the opinion that Sibpur training was not on right lines, and also that there were no appointments open for men of advanced training.

As regards the training of men for permanent-way works Mr. Jellett, the chief engineer, considered classes should be started at the various technical institutions or existing classes modified to meet the wants of railways, and if possible all railways should join in one common scheme.[1] As railways felt very much bound to help and give work to the sons of their employees, Mr. Jellett thought some scheme might be introduced under which railways could nominate students to these classes, the railways guaranteeing the necessary educational qualifications of their nominees. He kindly gave us his opinion of the courses which would be necessary for these classes, and the standard of work required. After the college courses, students would be taken on by the various railways as apprentice permanent-way inspectors, and would eventually rise on fixed scales of promotion if they gave satisfaction.

Lower Hooghly and Clive Mills.

65. We interviewed the managers, Mr. Duncan and Mr. Lamond. We found that in their opinion there was no chance of employment for Indians in Jute mills, except as ordinary workmen. All the heads of departments were Europeans, and the opinion of the two gentlemen abovementioned was that no Indian could possibly control the turbulent class of workmen they had to deal with. This opinion was confirmed by all other mill managers we interviewed.

Messrs Burn and Co., Engineers.

66. We interviewed Mr. Taylor, the managing partner, and had a most interesting discussion with him on the possibilities of employment for Indians. He stated that his firm had a large number of apprentices who did a five years' training, and explained the difficulties, which as a commercial firm they had to face, in introducing any number of technically-trained apprentices who would be in receipt of higher wages, than those apprentices who joined them in the usual way. He was, however, prepared to take one or two in the electrical power-house, where technical training would be most useful. He would also be glad to get draftsmen with a fair knowledge of their work combined with practical training. He depended almost entirely on Indians for this work, and would much prefer the technical to the college trained man, if he were obtainable. He could take 10 or 12 of these men annually. He suggested that if Government were really in earnest about the greater field of employment for Indians they should give more contracts to firms in this country who would then

[1] See Chapter XIV, page 70.

necessarily be in a position to take a far larger number of trained men to act as assistants in the various departments, and that this method if carried through generally would naturally provide for many more men than could be at present employed. They had many Bengalees in their drawing office, also a fair number of Eurasians, many drawing salaries of R100 to R150 per month. Mr. Taylor was sure that in all cases these men would have been much more valuable if they had been technically trained. We were shown round their works and interviewed various members of the staff, who agreed with Mr. Taylor's opinions. In our opinion the works of Messrs. Burn & Co. offer a splendid opening for the trained Indian, provided he is prepared to take up any work which comes within the duties of a mechanical engineer.

Howrah Tramway Power Station.

67. There appears to be little or no opportunity here, the work being very small and of a special character.

Calcutta Electric Supply Company.

68. We had a long interview with the Agent and Manager, and the methods this Company adopts with regard to recruiting its staff were thoroughly discussed. The opinion here was that for their purpose the Eurasian seemed much better fitted for this special form of work than an Indian. They had men from Sibpur. He thought the training they had received was not exactly what was required, as they had not enough practical knowledge as fitters, etc. They were prepared to give opportunities to trained Indians in their power-house in which the new system of high tension was being installed, and consequently a better class of men would become necessary for switchboard work.

Calcutta Tramways Company.

69. Mr. Allen informs us that his company find their interests are best served by the employment of European officers brought out direct from England from the staff of big tramway undertakings, for all positions of trust and responsibility. Subordinate posts are filled by local labour, Eurasian and Indian, the men being trained up in the company's service to fulfil efficiently the duties attached to their posts. As far as this company is concerned the present Indian labour market meets all their requirements. In the event of Government deciding to increase the field for technical education in India he would not feel disposed to recommend any change in his company's present policy. He would, however, be prepared to assist any Government scheme for technical education to the extent of taking one or two students nominated by the principal of a Government technical training college, with a view to affording them an opportunity of gaining practical experience of commercial value, provided the nominee conforms with the rules and regulations of the company's organisation.

John King & Co., Engineers, Ship Builders and General Contractors.

70. We had a long talk with one of the directors, Mr. Geo. A. King, who said he was prepared to take one or two men as a trial, but if Government were to give them more work they would be in a position to employ more. We visited their works at Howrah and were also shown round by Mr. King and Mr. Gilmour, his partner. They were quite prepared to take a certain number of apprentices and give them a small salary to commence with, and agreed that they would get better men than they were able to at present. They had no appointments which could be filled by highly trained Indians and did not think that such men could at present obtain any appointments. Much interesting work

is being done in the shops, and they would be an extremely good training school for apprentices after completing their college course. Mr. King and Mr. Gilmour expressed themselves willing to co-operate in any scheme of technical education which might ultimately be settled in Calcutta; but as they were not in business for philanthropic purposes they suggested that Government should place more work in their hands in return for their assistance.

The Port Trust Commissioners.

71. We interviewed Sir Frederick Dumayne, the Vice-Chairman of the Port Commissioners, and Mr. Scott, the chief engineer. Sir Frederick stated that the work of the Trust was for purposes of administration divided into several departments, each having its special duties.

In the Marine department of the Trust in charge of the deputy conservator the qualifications required for most of the appointments, such as dock masters, assistant harbour masters, officers of light vessels, etc., etc., were those possessed by officers of the Mercantile Marine, and the appointments were commonly filled by selection from applications invited by public advertisement; and in like manner in the River Survey branch of the department the officers are also trained in nautical work as well as in marine surveying, and recently have been recruited from the training ships *Worcester* and *Conway*.

In the engineering department are comprised the staff of the civil engineers employed on the work of designing and building the docks, wharves, warehouses, railways, etc., required in the Port and the staff of mechanical engineers employed in the workshops, dockyard, locomotives, dredgers and other steamers.

The staff of civil engineers are appointed by selection from sometimes as many as 80 applications received in answer to public advertisement, and a knowledge of harbour work is insisted on because the works to be carried out in Calcutta are mostly of this character.

The Commissioners, however, have in their employment several Indian engineers, natives of Bengal, engaged in designing, construction and maintenance, who have given every satisfaction.

Mr. Scott said that in his experience he had employed several men trained at the Sibpur and Roorkee Colleges and was satisfied with them. But speaking generally it might be said that the Indian engineer was better in office and field work than on executive duties such as the construction of work and control of labour.

The superior appointments on the staff of the mechanical engineers are also filled by selection by men trained in workshops at home, possessing experience in steam, hydraulic and electrical engineering, but these selected appointments are very few.

All the other engineers in the mechanical staff are recruited locally, most of them having served their apprenticeship in local workshops, many in the Port Commissioners' workshops, where they have acquired the necessary experience for the satisfactory discharge of such duties as that of foreman of workshops, of engineer of vessels, of hydraulic and electric-power houses, dredgers and other vessels, locomotives, cranes and other machinery.

Nearly all the engineers or drivers of the smaller vessels of the Trust, such as tugs and ferry steamers, the locomotive drivers and crane drivers are Mahomedans on salaries ranging from R18 to R75. Up to this time no qualified Hindus have ever come forward for appointments of this class. The work of the Trust has to a large extent been carried out by the Anglo-Indian and Mahomedan who for many years have held a large proportion of the posts on the subordinate staff in this as in all the other departments.

There is no restriction in respect of any race or class. The subject is treated commercially, the objects being economy and efficiency.

The Commissioners might be disposed for their encouragement to allow a few students trained in colleges in India to join their staff temporarily for the purpose of gaining practical experience, but owing to the fact that the few better appointments are, and must continue to be, filled by men of special training, such as civil engineers trained on docks, at home and abroad, there would be little prospect of employment being found for them in the Trust at present.

E. I. R. Carriage and Waggon Works, Lillooah.

72. We visited the Lillooah workshops of the East Indian Railway and saw Mr. Danby, the superintendent of the carriage and waggon works, who stated that for many years they had taken apprentices for five years' training, both Europeans and Indians. These had so far not turned out really satisfactory. He had last year got some mechanical apprentices from Roorkee, who were of a far better class than the apprentices he had so far. Their character, physique and everything about them rendered them more useful and capable of doing the work required. He found in most instances the Bengalee was not physically capable of continuous hard work.

Mr. Danby stated he would be glad to take more apprentices from any technical institute if their training was on the right lines, *i.e.*, similar to the apprentice course at Roorkee. He did not feel disposed to take men from Sibpur at present, but provided their course was altered in character he would be prepared to give men a trial. In Mr. Danby's opinion there was no demand for a man with very advanced training, and most employers would much prefer a man of moderate attainments who could be moulded to suit their requirements. We also interviewed Mr. Kendrick who expressed similar opinions to those of Mr. Danby. Their demand for men was continually increasing, and they found great difficulty in obtaining recruits of the right class. We were shown round the works to actually see the type of work carried out by the apprentices.

Mr. Jotindranath Bose.

73. Colonel Atkinson had an interview with Mr. Jotindranath Bose who passed out of the Roorkee electrical engineer class when it was a training course for the Telegraph department. He stated that since he left Roorkee he had had several temporary posts in the Calcutta tramways, oil companies, etc., but could not obtain permanent work as an electrical engineer. He did not think there were any openings for this class of men, and most of the men who had failed to get appointments in the Telegraph department had turned to civil engineering. One was municipal engineer at Patna on R350. There were many openings for electrical and mechanically-trained men of a lower grade.

Calcutta Municipality.

74. We visited Mr. Mukerjee, the Vice-Chairman of the Calcutta Municipality, who stated that they had vacancies occurring in the various departments, and that except for work of a civil engineering character there was a difficulty in obtaining properly trained Indians for posts requiring practical knowledge of mechanical engineering. The Chairman of the Corporation would be glad to do his best for the employment of technically-trained Indians. As regards technology or systematic knowledge of the industrial arts required for the country, although an Indian himself, he did not think that a very high class of theoretical knowledge was necessary at present, but that something of the character of industrial and commercial education combined was the proper thing. In his opinion, the proper method of training was for Government to start small factories on commercial lines in which it would be possible for students to learn such useful arts as dyeing, glass-making, spinning, weaving, metallurgy, manufacture of metallic implements required for various arts, manufacture of manures, medicines, etc., etc. If this work was combined with technical education, he considered Indians would then be in a position to start works for the industries in which they or their countrymen had been practically trained.

Eastern Bengal State Railway.

75. We interviewed Colonel Browne, General Manager of the Eastern Bengal Railway, Mr. Taylor, the chief engineer, and Rai Bahadur Rala Ram, deputy

chief engineer. They woud be glad to take engineering and electrical apprentices of the "Improver Class" into their departments, and also men who could undertake interlocking signal work, and all were decidedly of opinion the technically-trained men whose education was on proper lines would be much more valuable to them than those they were able to train themselves. The training and education proper for a railway to undertake was, in their opinion, limited in character, and they could not consider the possibility of establishing a school on the lines of that at Khargpur. They had great difficulty in obtaining a proper class of men as permanent-way inspectors, and would be glad to join a scheme for training such as that suggested by Mr. Jellett, chief engineer, Bengal-Nagpur Railway. They quite agreed with the views expressed by him as to the disadvantages of the present methods of recruitment, and also with the proposals set forth for training courses and approved of the idea that they, in common with other railway companies, should be allowed to nominate students who were sons of their present employees, always providing that the education they possessed was of the required standard.[1] Colonel Browne said that so far as the civil engineering side was concerned they did not find any great difficulty in meeting their requirements, and although they had had some good men who had been trained at Sibpur in civil engineering classes, he could not say the same about the mechanical and electrical men, and in his opinion their education was not sufficiently practical and left much to be desired. This opinion was confirmed by Mr. Taylor, the chief engineer, and by the deputy chief engineer. It appears that there is a large opening for properly trained men on this railway, and providing they can get Indians of any class who will work, they have no objection to employing them. The opinion expressed was that a very advanced training is neither necessary nor desirable, and they could not give employment to Indians with such training, as for many years to come such men must be Europeans specially selected for their experience in the various branches of work they control.

Messrs. Andrew Yule & Co.

76. We interviewed the managing partner who stated that he would be glad to give a chance to properly trained Indians in their jute and cotton mills provided that such men could be obtained. At present the junior staff in their cotton mills was recruited mostly from the Bombay side. His experience was that these men had been most satisfactory, and he suggested that the establishment of an institute in Calcutta which would train men on similar lines to the Technical Institute in Bombay would be most useful, and also that the manufacture of jute should be taken up in such an institute as well as that of cotton. He was dubious about the employment of men with a very advanced training, and told us that for their jute mills they had no difficulty in getting men from Scotland with plenty of practical experience on ₹250 to ₹300 a month, and that such men were, from the commercial point of view, infinitely more valuable than Indians would be even although the latter possessed a far better general education. He quoted instances of Indians who had been through a technical course in England or Japan, who with this educational asset only, demanded more money than he could get the experienced Scotchman for. He thought that with the great advance electric power is making, there would be many openings for electrical engineers of the "Improver Class" in the near future.

Messrs. Birkmyre Brothers.

77. We interviewed Mr. A. Birkmyre whose opinions generally coincided with those expressed by Messrs. Andrew Yule & Co. He arranged to take us to one of his mills to see the character of work which was demanded from employees, which we had great pleasure in doing. Mr. Birkmyre was not of the opinion generally expressed that technically-trained Indians could not be introduced into responsible positions in jute mills, but was of the opinion that such men owing to the characteristics required for this work must be restricted to certain races of Indians. No such men were at present available, but if they were

[1] See Chapter XIV, page 70.

available of a good type, as a commercial matter they would be freely engaged if they proved cheaper and as reliable as the class now available. He was very much in favour of technical education on the right lines and of the sight standard, but deprecated giving any education for which avenues of employment were not available, as technical education could not produce industries, character, or commercial instincts. If the time came when suitable men were available he would be glad to give a trial to a certain number of men.

Government Weaving School, Serampur.

78. We were received by the Principal, Mr. Hoogewerf, and Mr. Hurst, the Assistant Principal, who are both old students of the Victoria Jubilee Technical Institute, Bombay. We were much struck with the sound practical work which is being done in this institute, and are of the opinion that it must eventually do good to the handloom weaving industry in Bengal. The scheme of having branch institutions in various centres controlled by the present institute is sound, but the Principal was of the opinion that if this system is to be extended successfully an increase to the staff will become necessary, as the supervision of work in the branch institutes already took up a great deal of his time. We were informed that the students purchased all their own yarn and were, under the direction of the staff, allowed to weave the same into cloth which they afterwards sold. This system tends to produce careful and accurate work from the student as he is dealing with his own materials, and is consequently less reckless than when such materials are supplied by the State. The organisation, work and equipment of this institute as a school for handloom working created a most favourable impression which we were called upon to record in their visitor's book. From the records kept in the institute it appears that a large number of passed students are satisfactorily carrying out the object for which the school was established.

The Mint.

79. We were received by Colonel Cordue, the officer in charge, and were shown through all the departments by him. The work here is of a very special character, and there would be few openings for employment for technically-trained Indians. Colonel Cordue would, however, be glad to give a trial to two or three apprentices of the "Improver Class" and if possible increase that number in future. He had absolutely no openings for a highly trained man. He already had an apprentice system, which, to a certain extent, met his wants, but Colonel Cordue was of the opinion that a technically-trained student of the "Improver Class" would undoubtedly, after a apprenticeship, turn out a better man than one who had no previous technical training but had to do his whole apprenticeship in the Mint.

All apprentices in the Mint are employed in the Mint workshops where they do the same work as the ordinary workmen. In the evening they attend the classes of the Calcutta technical school, this being one of the conditions of their apprenticeship.

The apprenticeship lasts for five years, at the end of that time the lads have received a sound practical education, and find no difficulty in getting situations. Only about two per cent. of them get employment in the Mint.

In selecting lads for Mint appointments a high standard of moral character as well as of technical ability is necessarily adopted.

Sir Thomas H Holland, Geological Survey of India Department, Calcutta.

80. We discussed with Sir Thomas H. Holland the subject of employment of technically-trained Indians, especially with regard to the requirements of the mining industry, and his conclusions may be summarised as follows:—

(1) Managers of mines are obtained almost wholly by promotion of subordinates, who (*a*) have had a practical apprenticeship, and (*b*) have been in responsible charge of minor posts.

(2) Unless, therefore, Indians of the better class begin as English boys do, as workers underground, they can never be mine managers. There will be exceptions to this rule in men who have natural practical instincts, and have been in charge of small mines with a provisional certificate from the Chief Inspector of Mines.

(3) If the foregoing premises be true, raw students sent to England with scholarships, to take the B.Sc. Tech. in mining, of our younger Universities, must almost invariably be failures. Without previous practical experience in mining, they are unable to take full advantage of the University training; there is no living connection in their minds between the principles of science which they imbibe at the University and the problems of underground life. As a consequence of taking the University degree, they are unfitted, at the age of 23—25, for underground work in a subordinate capacity. Being generally poor students hitherto dependent on their scholarships, even for a living, they cannot afford an apprenticeship of five years, even if by temperament they were suitable for underground life.

(4) A good mine manager, like a master mariner, can only be made through discipline. Students sent to England for three years on a luxurious pay are never subjected to discipline. Mistakes made in questions of ventilation, and regarding the properties of explosive gases and dust, can be corrected in the laboratory—carelessness and slackness in these matters underground lead to disasters. Students who have not gone through the rigid discipline of a mine, where mistakes are generally fatal, can never be trained after their free life at an English University. In other words, State technical scholars in mining are students who have been decoyed and ruined by Government.

(5) What applies to the products of English Universities will apply also to a mining college in India, whether situated within or without the mining districts, the raw student in Arts and science cannot be trained in such a college to qualify as a mine manager, while the apprentice at a mine cannot generally afford to cut out three years of his career to go through an ordinary diploma or degree course.

(6) It follows from (5) that a mining college will not be useful unless it provides evening, or out-of-shift, classes for the mine subordinate and apprentice. Such classes are essential in order that a young man going through the practical training at a mine may prepare for the examination which he has to pass for the mine manager's certificate under Act VIII of 1901. It is evident that the apparent failure of the mining classes at Sibpur, and the marked success of the evening classes on the coal fields, are due to the facts that very few students can afford a full-time course in a college, and that those who take such courses are less likely to succeed than the ordinary mine apprentice who supplements his practical training with just enough of scientific principles to form a wholesome blend. Day mining classes, such as are established at Sibpur, would just as conspicuously fail if the college were at Asansol. People generally seem to be unaware of the fact that there is the same contrast in England between our University classes and our evening technical school classes in mining. From the point of view of attendance the University mining classes at Newcastle, Sheffield, Leeds and Manchester are failures, while evening classes are crowded in all mining districts. The Birmingham University can make a better show, but only because the Indian State technical scholars have been sent there to have squashed for ever any chance that they may have had of becoming mine managers. In considering the question of providing facilities in the way of mining colleges in India, it is well to remember that the manufacture of a mine manager is similar to that of a ship's captain. Unless the young Indian of the better class is willing to get to sea like the young English "middy,"

facing a hard life and receiving his share of kicks and cuffs, India will produce nothing more than fairly good *serangs*. Before you start a school of mines in India, like those of South Kensington, Camborne and Houghton, think of what would happen in analogous circumstances if you opened a *Conway* or a *Worcester* on the Hooghly. You may get two or three domiciled Europeans and one or two young Indians, who are sons of mine managers or mine owners. You will but afford another illustration of the wide gap between industry and education in this country, where practical men are uneducated and educated men are unpractical. This gap will be filled in time by evening classes and by picking out conspicuously intelligent senior subordinates for higher training in Europe, not by sending raw students to English Universities and technical schools, or by providing this class with similar facilities for theoretical training in this country.

The East Indian Railway Workshops, Jamalpur.

81. We interviewed Mr. D. St. Clair Wedderburn, the loco. superintendent, Mr. H. Tyson Wolff, the electrical engineer, Mr. Walker, assistant works manager, and Mr. Foreman, the chemist and metallurgist.

Mr. Wedderburn stated that they had had a good deal of experience in passing apprentices through the works. Their experience was on the whole unsatisfactory. He thought that before any scheme was adopted for the admission of technically-trained apprentices, the question should be decided by the Joint Railway Board. He admitted that the men with a suitable technical education would in the long run be useful. There was no opening for the man of advanced training as a foreman or overlooker, and posts were filled up from their own men after long actual experience in the particular class of work.

Mr. Walker stated that the workmen, that is the Indians, were usually the sons of employees in the works, some of them were now in the third generation, and were splendid workmen. He had an enormous number of apprentices of the Improver Class passing through the shops who usually considered that when the term of apprenticeship was ended they would be found positions in which there was little or nothing to do except sign requisitions and superintend other men at work. He would be glad to have men who had been properly trained technically and who would work with their hands; there was plenty of room for such men, but up to now he had not met any.

Mr. Foreman would be glad to have a man or two with a sound training in practical chemistry to assist him in metallurgical work; he had to train all his own men.

Mr. Tyson Wolff stated he would be glad to take apprentices of the "Improver Class" who had been well grounded in electrical work in a technical school, but he could hold out no hopes of employment for more highly technically educated men.

Bengal Technical Institute, Calcutta.

82. We visited the above Institute and were conducted through the various departments by the superintendent.

The equipment in the mechanical engineering section is fairly complete and a good deal of useful work is being carried out. The equipment in the other sections leaves much to be desired, and the buildings and class room accommodation are not of a suitable character for the class of work undertaken.

The standard aimed at is rather ambitious for the staff to carry out successfully with the equipment they have at command, and it appears necessary that both should be strengthened.

The prospects of the students were discussed, and we learned that considerable difficulty was experienced in obtaining employment for them. The Superintendent and staff appeared to be doubtful as to whether the lines on which they were working at present, were not too advanced in character,

and asked us to meet their committee and discuss with them suggestions for modification. This was done, when the gentlemen whose names given herewith were present, and we understand that they may probably undertake some changes in the scheme of studies with a view to rendering them more practical and in keeping with what is demanded by employers:—

1. Sir Gurudas Banerji, Kt., M.A., D.L.
2. Sir Rajendranath Mukerji, K.C.I.E.
3. Mr. T. Palit, Bar.-at-Law.
4. Mr. A. Choudhury, M.A.
5. Mr. J. Choudhury, M.A.
6. Mr. A. Rasul, M.A.
7. Dr. Nilratan Sircar, M.A., M.D.
8. Dr. Indumadhab Mallik, M.A., M.D.
9. Dr. Hirendranath Datta, M.A., M.D.
10. Mr. Satyananda Bose, M.A., B.L.
11. Mr. Prasanna Kumar Sen, L.C.E.
12. Mr. Charu Chandra Mitter, B.L.
13. Mr. Shailendranath Mitter, Zamindar.
14. Mr. R. Mukerji, Bar.-at-Law.
15. Prof. R. Coulon.
16. Prof. Manindranath Banerji, F.C.S. (London).
17. Prof. C. C. Sen, M.A., F.C.S. (Leeds).
18. Prof. Rakhal Chandra Palit, M.A.
19. Prof. Bhim Chandra Chatterji, B.A., B.Sc.
20. Prof. P. C. Ganguly, B.Sc. (Glasgow).

Bengal Coal Fields.

83. We had three meetings on the mine fields when Mr. Adams, the Chief Inspector of Mines, invited all the Chief Superintendents to meet us, and lay before us the views of the mining community, as to the openings for employment for technically-trained men, the requirements of employers, and how those requirements can be met in the most efficient and practical manner.

The following is a list of the gentlemen we had the pleasure of meeting:—

G. F. Adams, Esq., Chief Inspector of Mines.
G. C. Leach, Esq., Inspector of Mines.
T. Adamson, Esq., Supdt., of Indian Collieries Syndicate, Ltd. (Kilburn & Co.).
R. Browne, Esq., Supdt., Eastern Coal Co., Ltd. (Mackinnon, Mackenzie & Co.).
E. S. Bennertz, Esq., Supdt., Kusunda and Mayadik Co., Ltd. (Martin & Co.).
R. Bathgate, Esq., East Indian Coal Co. Ltd. (Jardine, Skinner & Co.).
J. Kean, Esq., Raniganj Coal Association, Ltd.
D. Brown, Esq. (Kilburn & Co.).
C. Navin, Esq., Supdt., Equitable Coal Co., Ltd. (Macneill & Co.).
F. Owen, Esq., ditto ditto.
G. Miller, Esq., ditto ditto.
Dr. O'Connor, ditto ditto.
P. Keelan, Esq., Katras-Jherria Coal Co. (Andrew Yule & Co.).
F. Agabeg, Esq. (Apcar & Co.).
Glen George, Esq., Supdt., Bengal Coal Co., Ltd. (Andrew Yule & Co.).

The unanimous opinion of these gentlemen representing the weight of opinion of the whole coal fields is detailed in paragraph 203.

CHAPTER IX.—CENTRAL PROVINCES.

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A. G. Wright, Esq., Director of Public Instruction.

84. We were associated with Mr. A. G. Wright, Director of Public Instruction, who kindly arranged for us to see all employers of labour available and other gentlemen interested in technical education. We also had the honour of being received by the Hon'ble Mr. Crump, Officiating Chief Commissioner of the Central Provinces. Mr. Wright stated that technical education in the Central Provinces was in its infancy and the opportunities for employment were few.

"At present an engineering school was being built which would be attached to the science college. The aim would be a school in two departments, one civil engineering teaching up to the overseer standard, a class of men for which there is likely to be a considerable demand, and the other mechanical engineering, which would chiefly cater for turning out mechanical engineers for the ginning and pressing factories which existed, and for such general mechanics as might be wanted by the agricultural industry. The idea was to start this branch with an open mind and to develop it as circumstances might show that the nature of employment existed for the output. It was intended as a start to complete the training of these students in the Public Works Department Workshops, Nagpur.

"As regards technical scholarships tenable in England, I am entirely opposed to the present system. It appears to me to exercise no beneficial effect on the industries concerned. It benefits merely the individuals selected as scholars inasmuch as they receive a training which is some claim to higher pay on their return. I have not been able to discover a case where a returned scholar has introduced any improvement or radical change in an industry. Further, as a matter of detail, annual selection means less selection.

"I would place the possibility of electing scholars in the hands of local Governments unconditionally. The basis of election should be (1) that the selected man should have done practical work in the industry in India of such kind, and for such a term of years, as would ensure that he had mastered all he could learn in this country; (2) that the course of study he proposes to take up should be such as can and is likely to be applicable to the improvement or extension of the industry in India, and not merely educative of the individual or profitable as an individual qualification for higher pay."

C. E. Low, Esq., C.I.E., I.C.S., Director of Agriculture and Industries.

85. Mr. C. E. Low, C.I.E., I.C.S., Director of Agriculture and Industries stated in an interview that the main industries with which he was specially acquainted were manganese and coal mining. In the manganese mines, which were at present surface quarries, there was little opening for employment for technically-trained Indians, and the little there was could be met from the proposed school of engineering.

The coal mines were too scattered for the formation of night schools, and any assistance required in other training for this industry must be met from the proposed school of mines at Asansol.

There was practically no opening for the employment of mechanical or electrical engineers in the Central Provinces, except in ginning and pressing factories. This want was being arranged for in the new school of engineering. The Empress Mills met their own demand by their apprentice system. Mr. Low stated that he considered the present system of State Scholarships to Europe was unsound, in that they have not turned out men of the kind intended, the many well known disdvantages of this system outweighing any slight advantage gained.

He considered they should be abolished, but if it was desired to continue them these were desiderata.

(1) Only men should be sent who can see their way to secure employment on unprovided terms on their return to India.

(2) That men should be sent who had had considerable practical experience already in India which, however, would mean that Government would bear the expense of sending to England the servant of some firm, to improve himself for the advantage of that firm.

He stated that in his opinion technical education would not produce industries, but it was necessary to educate the minds of Indian gentlemen of capital in such a way that they would see the advantage of starting industries, technical education following in their wake. Beyond the Empress Mills (run by Parsees) ginning factories and some oil mills, there were no other signs of industrial development in the Central Provinces.

H. M. Hance, Esq., the Indian Manganese Mining Syndicate.

86. Mr. H. M. Hance of the Indian Manganese Mining Syndicate corroborated the views expressed by Mr. Low with regard to the openings for employment in manganese industry.

The Government School of Handicraft, Nagpur.

87. Mr. E. E. Cove, Head of the Government School of Handicraft, Nagpur, explained the object of that institution which is, however, more connected with industrial than with technical education.

The School of Science, Nagpur.

88. We visited this institution and were shown over by Mr. R. Reckett, the principal. We saw the site of the new school of engineering.

Public Works Department Workshops.

89. We were shown round these by Mr. Joyce, the officer in charge. It is proposed to do part of the training of students of the mechanical branch of the school of engineering in these workshops.

Dr. Laxman Narayan, Proprietor of Manganese Mines, Tile and Brick Manufacturer, Kamptee.

90. He stated there were few openings in the manganese mining industry ; there were openings in the Public Works Department, and the ginning and pressing factories. He also stated he did not agree with the principle of sending State scholars to Europe, as there were no openings for these men on their return, and that for the same reason, the country was not yet ready for advanced education in mechanical and electrical engineering.

The Central India Mining Company.

91. Mr. H. D. Loggan of the Central India Mining Company agreed entirely with the opinions expressed by Mr. Low and Mr. Hance with regard to the manganese mining industry.

The Berar Victoria Memorial Technical Institute, Amraoti.

92. This institute is now in the 3rd year of its existence, and was established for the education of mechanical engineers up to the standard required for the 2nd class Boiler Act examination, and also for artisan classes.

The school has now 28 students on the register in the higher class, 12 students in their 3rd year, 6 in the 2nd, and 4 in the 1st, and only 6 students in the artisan class, for which eight scholarships are given. The qualifications for entrance are extremely low, the authorities finding themselves in many cases unable to get students who have even passed the 6th standard in English.

The courses laid down are, in our opinion, too ambitious for students of this standard; the courses in the science section are too extended for the class of men it is proposed to educate. If the right class of students can be made available it is evident that the staff must be considerably strengthened and increased.

The equipment in the physics and chemistry section is inadequate to teach the elementary portions of this work practically; at present there is no practical work in chemistry.

The equipment in the workshops is good and ample for the present number of students.

Rao Bahadur Trimbak Rao Sathe, Nagpur.

93. At present in the Central Provinces the several concerns that are in need of employing men having technical knowledge of the kind taught in the technical institutes, are cotton spinning and weaving mills, cotton ginning and baling factories, Municipalities and Government Public Works Department, which have had to use steam power. Some of them, such as cotton spinning and weaving mills, employ them permanently, and others, such as cotton ginning factories, require them only during the ginning season, which does not last longer than 6 months. This again is controlled by the state of the cotton crop. As regards the Municipalities such of them as have their water schemes worked by steam power, employ them, but their number is not large. Thus the majority of their employers are owners of cotton spinning mills and of ginning factories. Taking the present circumstances into consideration the supply of trained men is not in excess of the demand. I may note here one circumstance respecting the knowledge acquired by those men; it has been said that they possess more theoretical than practical knowledge of the work they have to do. Very few, if any, have been found able to do their work with their own hands in the mechanics' shop, which is required to be kept up attached to the up-country factories, such as of turners, smiths and moulders.

The spinning and weaving mill and ginning factories require properly trained men to work as jobbers and fitters in their several branches or departments of spinning, weaving, bleaching and dyeing on whose abilities depend the proper adjustment of machinery whose parts are in need of being constantly changed to meet the requirements of the trade, or making correct admixture of materials required for sizing, bleaching and dyeing operations. At present they do not get properly trained men to do this sort of work. In all these cases the quality of the finished articles for the trade depends on that of their preparatory stages which are in charge of jobbers and fitters. For instance, no yarn of any count of properly uniform twist and thickness can be produced, unless laps and silvers supplied for the purpose from the preparatory operations are of the same uniform quality.

In conclusion I beg to give a list of men who worked or have been working in our mill after they had completed their course in the technical institute. We have at present working in the Pulgaon Spinning and Weaving

Mill, the following men who have been trained in the Bombay technical institute:—

(1) Mr. Narayen Vithal Tamhankar, trained as mechanical engineer, has been working as spinning master ever since he has been in the service for more than twelve years.

(2) Mr. G. L. Joshi works as our weaving master. He held a Government technical scholarship and was sent to England for training in the textile industry. He was employed on his return after having remained there for three years.

(3) Gajanan Vithal Kane works as an assistant engineer. He finished his course of the technical institute in December last. He was our mill scholar at the Bombay Technical Institute.

(4) A. M. Bose has been working as assistant weaving master since his employment in our mill after the completion of his course in the Technical Institute.

(5) Raj Gopal Ayangar left the Technical Institute before completion of his course there. He was first employed as a jobber in the spinning department and has now been promoted as assistant spinning master in the same branch.

The following men were employed in the mill after they had completed their course in the Bombay Technical Institute but subsequently left our service and had been employed somewhere else:—

(1) V. T. Pathak got a Bombay Government Scholarship and went to England for being trained in the textile industry. He was employed in our mill as assistant for some time and then weaving master.

(2) A. P. Patwardhan worked as assistant weaving master in our mill and then went to England with a Bombay Government Scholarship like V. T. Pathak.

(3) C. Naidu worked as assistant weaving master for some time and then went to England with the Central Provinces Government Scholarship.

(4) P. M. Tamil worked as assistant weaving master.

(5) S. K. Padhye was trained as a dyer at the Baroda Kala Bhawan. He worked in our mill as dyeing master.

(6) N. K. Pille worked as assistant weaving master.

(7) R. S. Jog worked as Assistant Engineer: was our mill scholar at the Bombay Technical Institute.

The Hon'ble Sir Gangadhar Rao Mahadeo Rao Chitnavis, K.C.I.E.

94. The points referred to me do not cover the whole ground of technical instruction, the true object of which, in my humble opinion, is and should be in the present state of the industrial and commercial development of the country, not so much the supply of existing demands, as to attract Indian talent to commerce and industry. For the attainment of this object, it is necessary that State scholarships for technical and industrial training abroad should be given to promising young men who can command sufficient capital to start business on their own account on their return. The production of skilled servants is, after all, only a subordinate question. Much cannot be done in that way for the encouragement of indigenous industry. We must attempt something higher, and infuse an active industrial spirit among the wealthier classes. The present system whether of State scholarships or of technical education in India, seeks to train young men in special subjects with a view to supply to manufacturers qualified servants. Should this principle not be departed from the result in a few years will be to create a numerous and increasing class of young men, without any high standard of general education, such as could give them a due sense of proportion and could ensure a balanced mind, with extravagant ideas of their own importance and capabilities. As the field for the utilisation of this material will be limited so long as there is not a large expansion of the industries, there is ground for the apprehension that discontent will follow any large addition to the class. But once the principle of State education

is changed and monied classes are inspired with a desire for expert training, the field for employment even of the former class of young men with more knowledge than cash will be unlimited, and industrial and commercial activity will be fostered in a manner which will carry the best guarantee for success and lasting good. I request you to kindly consider this feature of the question along with the others that fall within the scope of the enquiry Government has so considerately ordered, and on which I shall presently record my views. One consideration will demonstrate the necessity of the adoption of the suggested principle in this matter of State education in the technical department which, it must be admitted, is different to that which underlies State education in the general department. Old records will show that the system of general education now prevalent was initiated primarily for the supply of servants for the Government. The administration could not be carried on wholly with the help of imported labour. A body of servants trained in general subjects of education in India was therefore a necessity, and for the production of such a class the money qualification of the recipient of the education was at once unnecessary and inconvenient. But in the technical department the direct Government requirements are few, in the employment of the trained scholars private fields must be exploited to a much larger extent. To prevent disappointment to help the cause of Indian industrialism the possession of sufficient cash by the scholar is therefore absolutely necessary.

I now take up your questions in their order—

(1) Even in existing conditions, the field for employment is large if the exclusiveness of some of the employers is overcome. The railways and the navigation companies, for instance, provide an increasing number of berths to men trained in the technics. We have now about 33,000 miles of railway in India, and the mileage is expanding. This must have a large room for employment if only as foremen, drivers, fitters, guards, carriage builders and engine makers. There are very few Indians now employed.[1] They have not had their chance in this line. The navigation companies too do not now employ them; except in the lowest rungs of the service. I do not see why trained Indians should not be employed in the higher ranks. Shipbuilding is not undertaken in India, and yet the time will come when an attempt will have to be made. That is a virgin field. Government has its own factories, workshops and farms with large capacity for absorption of trained material. The growing mills, the business houses, the banks, the engineering firms and a host of other special institutions that could be named could employ for years to come almost all the material turned out by the technical institutions, either now existing or which may be started in the course of the next few years.

(2) The employers want good *practical* training in their staff, in addition to theoretical knowledge.

(3) Except the workshops, admission into which is by no means easy, there is hardly any suitable arrangement now for the importation of practical knowledge to Indians. The Victoria Jubilee Institute, the Thomason College, Roorkee, and perhaps the Poona Engineering College are the only institutions the graduates of which find ready employment, and can turn out good work. The railway workshops, where apprentices are admitted, provide employment for the young men trained in them. There is lack of proper institutions.

(4) More technical institutions should be started, with special departments for practical training, and principal departments should be added to the existing institutions. Branches of study which are useful, but not attempted now, such as mining, metallurgy, glass manufacture, watch manufacture, shipbuilding and navigation, should be added to the present curriculum, and suitable arrangements should be made for thorough instruction of a practical nature in them. For the higher branches of technical and industrial knowledge, provision has likewise to be made, and technological colleges and research institutes ought to be gradually established. I had a mind to refer

[1] See paragraph 164. The number of Indians employed on railways in various capacities runs into very large figures.

to the attractive, and in my opinion very necessary, subject of industrial schools, but I feel any remarks I might offer on it would appear to fall outside the scope of the present enquiry. If, however, you desire to have my views on it, I shall gladly record them in a future letter.

Empress Mills.

95. We had an interview with Sir Bazonji D. Mehta, Manager, and his son, Mr. Sorabji B. Mehta, Assistant Manager. This is a group consisting of five mills at Nagpur belonging to the Central India Spinning, Weaving, and Manufacturing Company, Limited, under the agency of Messrs. Tata, Sons and Company. Besides this group Messrs. Tata, Sons and Company manage the Svadeshi Mills at Kurla, and the Advance Mills at Ahmedabad. There are only four Europeans employed in all these mills.

The Central India Company as well as the Svadeshi Mills Company have for some years gone in for a system of apprenticeship on agreement. We give below particulars of the Central India Company's system :—

(1) Apprenticeships for University graduates, in spinning and weaving. The apprenticeship is for five years, during the first three years of which the apprentice receives a stipend of R50, R75 and R100, respectively. If approved he serves for another two years, apprenticeship on R100 for the fourth year, and R125 for the [illegible] year.

[illegible] apprenticeship in spinning and weaving for five years, [illegible]hich the stipends are, R20 for the first three years and [illegible]of R100 if approved at the completion of three years' [illegible] the next two years.

[illegible]ticeship in mechanical engineering; under this agreement the [illegible]prentice serves for three years on R20 a month and on the [illegible]mpletion of that period is expected to pass the 2nd Class Mechanical Engineers' Examination. If successful he is given a bonus of R200 and R40 a month for two years and R60 for the remaining three years of his agreement. Besides the terms given above, special merit in all classes is recognised by the grant of increased pay or extra bonus.

The number trained from 1877 to 1912 were—

—	Ordinary.	Graduate.	Total.
Total number trained to date	142	17	159
Number who had left the Company's service	87	9	96
Number who remain in the Company's service at present . .	55	8	63

A record has been kept of the men who left the Company's service, and a certain number were doing well in good positions in other mills, while a number had taken up other means of earning their livelihood.

Sir Bazonji stated that, though he was of the opinion a man well trained in a technical school and prepared to begin practical apprenticeship in a mill on the lowest rung of the ladder, would eventually be a better man than an apprentice who had never been to a technical school, yet his Company would not take men from technical schools. The reason being that the student on leaving a technical school after three or four years' education, expected a much higher salary than the R30 the Company gave to their apprentices. If this was granted it would dissatisfy their own apprentices, and further the student from the technical school was not nearly so valuable to the Company at that time as their own apprentices who gain more extensive practical experience of machinery and *men* employed in the special branch of their training.

Note from the Hon'ble Rao Bahadur R. N. Mudholkar.

96. I have understood the object of your inquiry to be to find out what kind of technical education is in demand in the different provinces and parts of

India and as such in need of provision, the answer to this depending upon the industries existing and carried on there, the methods, appliances and processes adopted therefore and the scale on which the operations are conducted in the different establishments. What I have stated in my note submitted the other day gives a general statement of my views as to the qualifications which the overseers and superior workmen in the establishments carrying on the various industries ought to possess, and for the supply of which suitable instructional institutions should be provided. I take it that what you want me to do is to specify with greater particularity and definiteness what I would like to see done in the different provinces. With all my materials and books of reference at Amraoti and the difficulty of getting any of the latter here I fear my suggestions will be very imperfect. I still, however, venture upon the task. I shall take my own sub-province of Berar and the Central Provinces first and then briefly touch the requirements of the other provinces.

In Berar there are some three hundred and odd factories, by far the largest number of which are engaged in ginning or pressing cotton. There are three spinning and weaving mills and six oil extracting and refining mills. The Boiler Inspection Act and the rules thereunder make imperative the possession of a certificate of competency by the person in charge of a steam boiler or other prime-mover. This requirement existing in the Bombay Presidency has conduced to no small extent to the considerable advance of mechanical engineering and other departments connected with industrial pursuits which is noticeable in that Presidency. It also accounts [redacted] satisfactory working of the factories there than of simila[redacted] like Bengal where no like requirements about qualifi[redacted] For the more effective, economical and profitable wo[redacted] for the improvement and advancement of the industri[redacted] men are wanted. First of all the rule under which a[redacted] journeymen mechanics are allowed to appear for the certi[redacted] ought to be rigorously enforced, secondly, the period of qualifyi[redacted] should not be less than five years, and, lastly, there should [redacted] examination in the theory and principles of the different subjects.[1] men who have worked as oilmen or fitters in a ginning or pressi[redacted] manage to get admissions to the examinations under the Boiler Acts, [redacted] is as rife in Bombay as elsewhere. I would prefer that admissio[redacted] examination for Engineer's certificates be confined only to students of a "[redacted] nised institution," the courses of instruction, theoretical and practical, in wh[redacted] should be raised and extended over four years. If the practice of admittin[redacted] apprentices or journeymen mechanics is to be continued then as I have said, the rule ought to be strictly enforced and none admitted who were not employed whole-time in making or repairing of engines and boilers. The workshops of the "recognised institutions" ought to be far better equipped than at present, and greater time and attention must be given to the practice therein.

The Institute at Amraoti should be strengthened so as to have one Professor from England. There should be a special Deputy Superintendent for the workshop, the equipment of which should include specimens of gas and oil engines and of ginning and pressing plants.

A similar institution should be provided at Jubbulpore for the northern part of the Central Provinces.

For the textile industries there should be a school at Nagpur giving training in spinning, weaving, sizing, bleaching and dyeing. Provision for instruction in hand-loom weaving will, I understand, be made in the school of handicrafts at Nagpur.

For the chemical industries there should be classes in Applied Chemistry attached to the Victoria College of Science at Nagpur for giving instruction in the extraction of oil by modern methods from linseed, cottonseed, tilseed, saffronseed, etc., in the refinement of the same and in the preparation of boiled linseed oil, paints, varnishes and candles.

There should be also a class for giving instruction in tanning and the manufacture of superior leather.

The Victoria College at Nagpur must be developed into a more practical institution in regard to other chemical industries also. The Lonar lake in the Buldana District is not utilised as it deserves to be, simply because modern

[1] See paragraph 195.

science is not applied to the proper treatment of its products. In the Dahihanda Pargana of the Akola District salt was obtained from wells. The unutilised resources of that tract can be turned to account by the help of chemistry.

For such of the students of the Nagpur Engineering College as desire to go in for constructional railway engineering arrangements should be made with the Bengal-Nagpur and Great Indian Peninsula Railway authorities to obtain facilities for practical courses in the construction and maintenance of permanent-ways.

Facilities for the students of the Amraoti Institute and of the proposed Jubbulpore Institute for the study of the special feature of locomotive engines and of their working should be provided at the locomotive shed at Badnera and the workshop at Jubbulpore respectively.

In regard to the institutions required for the higher and more advanced courses in the departments mentioned above, the Central Provinces and Berar will for long have to depend upon the superior institutions recommended in my note. I would request your perusal of it and would beg to point out that it contains matter which did not find a place in my note laid before the Allahabad Conference. I make the following supplementary suggestions.

The College of Science which would be established at Bombay from the munificent and princely donations made by Sir Chinubhai Madhaoji, Sir Karimbhai Ibrahim, and Sir Jacob Sassoon, should have a many sided practical character suited to the advancement of industries of Western and Central India dependant upon the application of chemistry. The tanning and leather industry, paper-making, the oil industry and those connected with it, and animal fats have achieved a fair measure of success, while that of the textile industries is beyond question. Institutions supplying the knowledge needed in these industries will be only meeting a long-felt demand. It is essential, however, that the practical training is of the kind which was afforded in the Madras Government Leather Factory which was carried on under Mr. Chatterton till last year.

CHAPTER X.—BOMBAY.

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Messrs. Currimbhoy Ebrahim & Co.

97. This company controls five mills. We had an interview with Mr. Ahmadbhoy Currimbhoy, the Hon'ble Mr. Fazalbhoy Currimbhoy, Agent, at which the following gentlemen were present :—Mr. M. M. Fakira, Superintendent; Mr. D. F. Batliwala, Manager; Mr. T. Watts, Carder and Spinner; Mr. J. W. Sankey, Weaving Master; and Mr. T. Taylor, Manager, the Currimbhoy Mills.

Mr. Fazalbhoy was of the opinion that students must undergo an apprenticeship after a college course if they are to be of any use. Their firm would take apprentices both in engineering and textile departments on a living wage. These gentlemen scouted the idea that jobbers ruled the mills, but considered an afternoon class for jobbers would be an excellent idea.

Messrs. Finlay & Co.

98. This firm controls the Swan and Finlay Mills. We had an interview with Mr. J. Simons, one of the managers of James Finlay & Co., Limited, and Mr. Goodwin, the manager of the Swan Mills.

They considered that it would be a good scheme to place apprentices in mills after completing their course at a technical institute, provided they were prepared to come, not as extra hands simply to look round, but to take any place temporarily vacant, and do whatever work they were told. They were very much in favour of an afternoon school for jobbers, and Mr. Goodwin considered if this could be successfully established, the general feeling of antagonism shown by jobbers to technically-trained apprentices, would probably die down once the jobbers began to realise the advantages of theoretical as well as practical training.

Messrs. Khatao Makanji & Co.

99. This firm controls two mills. We interviewed Mr. Goverdhandas Khatao and Mr. R. A. Tarkhad, the manager of the Khatao Makanji Spinning and Weaving Company, Limited. These gentlemen were very much in favour of a system of apprenticing technical students to mills, on a living wage, for at least two years. They stated they were much in want of well-trained men, but considered that technical courses should not only be restricted to one branch, such

as either spinning or weaving, but men should also further specialise either for carding or for spinning. They were doubtful about the advantage of an afternoon school for jobbers but would gladly give it a chance.

Mr. Goverdhandas Khatao thought that there were not at present openings for men with higher technical training in mechanical, electrical or textile engineering, but considered there would be, directly engineering manufacture was introduced into India, an enterprise he was very anxious to see started.

Mr. John Wallace, C.E.

100. We interviewed Mr. John Wallace, C.E., Editor of the *Indian Textile Journal*, an engineer of long and varied experience, who has been actively interested for many years in technical education. He indicated defects in the methods of education followed in some of the small schools he had inspected.

Mr. Wallace stated that the influence of the instruction imparted to trade students in the technical schools in India has not yet reached the working class. Even in Bombay during the last twenty years no improvement is observable in the methods or workmanship of the building and allied trades. A more direct method of instruction is needed. In proof of this he referred to the training of men and boys in the railway, dockyard and other workshops by European foremen on a non-literate basis and in vernacular, which has greatly increased the wage value of the work-people.

He advocated the training of a special branch of native instructors in handicraft for primary schools; the instruction to be on a non-literate basis and to deal only with the essential things pertaining to the prospective work of the pupils. For example, a year's special course should qualify a young carpenter to be an instructor in handicraft. All these instructors should be selected tradesmen who have practised a craft. The experience of many years has shown that four-fifths of the children who have been taught reading and writing forget it completely, having wasted the time of study that might have been better employed in learning useful things.

The instructor in handicraft, once trained, would always be a teacher whether he remained in a school or reverted to the workshop, and the money spent in his training would go further than if spent in any more elaborate course. A village school may be built of the same materials as the houses of the inhabitants only with more attention to lighting, ventilation and drainage. The open competition of foreign industries with those of India raises the improvement in efficiency of the Indian craftsman to the most important position in the educational scheme of the Indian Government.

Mr. Wallace also stated that the sending of Indian students abroad for the study of trades is of very doubtful value.

They sometimes work hard and gain many prizes, but only a small amount of their training has a money value here, and most of them would have done better to remain in India working and studying under local conditions. It is still true that the most highly paid mill managers in India are men who have obtained all their experience in this country.

Every year as industries extend, there is less need for study abroad, and if foreign study is considered necessary the student should have a good basis of Indian experience to start with, so as to correctly appreciate the novelties he encounters abroad.

Sir Sassoon David and Company.

101. This Company controls the Standard Mills, David Mills No. 1 and No. 2 and the Dawn Mills. We had an interview with Sir Sassoon David. He stated that he had always taken men from technical institutions into his mills, but considered a properly arranged scheme to apprentice students out in mills after their institute course would be likely to turn out a better class of men, and he would do anything in his power to encourage it. There was a small opening for men trained in industrial chemistry, but very few men were required and the remuneration was generally poor. He did not think an afternoon class for

jobbers would be of much value, but he thought it might be tried as an experiment. In his opinion there was no opening at present in India for men with a higher technical education.

Messrs. Bradbury & Co.

102. This firm controls the Colaba Land and Mills Co. and the New Great Eastern Spinning and Manufacturing Co. We had an interview with Mr. Bradbury and Mr. Knowles. Mr. Bradbury states he had tried many students from technical institutes in his mills. He found in the past they were unsatisfactory, as they would not stick to their work and obey orders, and rather disorganised the mill. He considered some apprentice scheme would be very satisfactory if the institute retained a tight hold over the students when they were apprenticed. Mr. Bradbury thought afternoon classes for jobbers might be useful, but was very doubtful on this point. The best jobbers were those called "Jorekamwalahs" who worked themselves up from erecting new machinery and repairing old machinery.

Bombay Electric Supply and Tramways Company.

103. We had an interview with Mr. Remington, the Managing Director, at which Mr. Moberly and Mr. Baker were also present. These gentlemen stated they had taken on men from the technical schools in the Presidency, and with a few exceptions, found them unsatisfactory; their training and knowledge seemed deficient. They had many posts in their company for which they had great trouble in finding good men, but unless they could get an improved type of student, who was ready to work and do what he was told they would prefer not to take them. If they could get the class of men they wanted, they would gladly give them a few apprenticeships.

Messrs. Marsland, Price & Co.

104. This firm is largely engaged in constructional engineering in reinforced concrete. We had an interview with both Mr. Marsland and Mr. Price. These gentlemen stated they had to get Europeans out from England to supervise their work as they found they could not trust Indians as a rule, though they had two excellent trustworthy men. They had found that the licentiates of Civil Engineering they had had under them were conceited men, who thought they knew everything, quarrelled with men and contractors, and were most unsatisfactory. From a commercial point of view their training was quite wrong, and they now preferred to train their own men.

Bombay Steam Navigation Company (Messrs. Killick, Nixon & Co.).

105. We interviewed the Superintendent, Mr. Conry, who stated they took a good many apprentices for five years, paying them four annas a day for the first year and increasing by two annas every year. He would be very glad to give apprentices from technical schools a trial if they would come at 10 annas a day, the rate paid to fourth year apprentices.

The British India Steam Navigation Company (Messrs. Mackinnon, Mackenzie & Co.).

106. We had an interview with Mr. Phillips who stated there were no posts for Indians on their steamers. The shops are well adapted for training apprentices, but a suggestion that Mr. Phillips should assist technical education by granting apprenticeships on living wages to a few Indians trained at technical institutions, was met with an emphatic declaration that he would not do anything whatever to assist or take any men.

Note from Mr. Phillips.

I am afraid I was rather under a mistaken idea as to the bearings of the question Lt.-Col. E. H. deV. Atkinson and yourself called to discuss the other day, and was not aware that it dealt with apprentices *only* and not journeymen or full-fledged engineers.

As you may know, our sea-going engineers are all Europeans mostly engaged at home, and of course there would be no possibility of employing any others in this capacity.

We take on local apprentices or improvers in the workshop here when there are vacancies for such.

Messrs. Osler & Co., Bombay.

107. The electrical engineer to the Company said he was taking on technically-trained students at present, and generally speaking, had found them satisfactory, and he would continue to engage them as opportunity offered. In many instances these men took charge of the working of small plants with satisfactory results.

He expressed the opinion that the average student (Indian or otherwise) found that most of the ordinary theoretical and laboratory courses in technical colleges, were of little use to him in the actual every-day work of an electrical engineer's and contractor's business. The student who went straight away into a designing office, or as assistant to a professor engaged on research work, would find the training most useful. Openings of this sort, however, for the Indian student were practically *nil* at the present time, and hence the syllabus for Indian students should be drawn up on a more practical line than that to be found in the home colleges, where the student had also the advantage of passing into large manufacturing works at the close of his studies.

The Madhowji Dharamsi Manufacturing Company.

108. This Company controls the Madhowji Dharamsi Mills. We had an interview with Mr. Goculdas Madhowji and Mr. Ashworth, weaving master of the mills. Mr. Goculdas stated that they had not a very happy experience with students from technical institutions, but though they were not at all hopeful would give a trial to apprentices. Mr. Goculdas did not think afternoon classes for jobbers would do any good, and although he did not seem to think much good could come to the mill industry through technical education, he considered there was no opening at all for highly technically-trained men.

The Emperor Edward Spinning and Weaving Co., Bombay.

109. This firm controls the Emperor Edward Mills. We had an interview with Mr. C. D. Panday, Manager of the mill. Mr. Panday was very much in favour of students from technical institutes being apprenticed to mills for two years on a living wage, no certificate to be granted till this apprenticeship was satisfactorily completed. It is doubtful whether the mill owners would be inclined to give even a living wage.

Mr. Panday considered there was a great need for an institution for the benefit of managers, spinners, weavers and engineers employed in the cotton mills in Bombay for the spread of scientific knowledge and the exchange of views. The Bombay Textile and Engineering Association should be the nucleus for such an institution. Closer touch was required between the foremen actually in service and the students of the Bombay Technical Institute and to ensure this the buildings of the Association should be in close vicinity of the institutions. Great apathy was shown by mill owners to the education of their employees. The sphere of influence of the Association should be to circulate journals, magazines and books bearing on the textile and engineering industries in their varied branches, to arrange for lectures on textile and engineering matters in their scientific and commercial aspects, and to hold evening classes for teaching students desirous of attending.

Associations like the Bombay Textile and Engineering Association should be encouraged in all large centres of industries, particularly where technical schools and colleges are in existence. This would enable the students to come in daily touch with those in practice and tend to improve their future prospects.

Messrs. C. N. Wadia & Co.

110. This firm controls the Century Spinning and Manufacturing Company. We had an interview with Mr. C. Wadia, who is the son of Mr. N. N. Wadia, C.I.E., the founder of the Bombay Jubilee Technical Institute, who acted for three months as Honorary Secretary many years ago. Mr. Wadia stated he had considerable experience of Indians from technical institutions and found their great faults were that they would not work the long mill hours, they were undisciplined, and would not do real hard work, though some showed considerable ability. Mr. Wadia considered the comparatively short hours of work put in at a technical institute had a softening effect on students from which they never recovered. The hours should be much longer, as the present hours tended to entirely unfit them for factory life afterwards.

He contended that the only salvation for the country, as far as technical education was considered, was to carry technical education on at the same time as practical work. As night schools were impossible in India half the day should be spent in the mills and half in the school. This scheme also presented great difficulties, but as far as his mills were concerned he approved of an afternoon school, and would send men from his mills, and thought several other companies who were really in earnest about technical education would do the same.

The next best system he considered was to apprentice out men from technical institutions on a living wage for two years, giving no certificate till this apprenticeship was satisfactorily concluded. He considered the technical institutes should carry out entirely separate courses in spinning and weaving and would even further sub-divide into carding and spinning, preparing and weaving. Mr. Wadia considered that technical institutions should test the character of their students and discard men who were unlikely to work hard and stick to their work. There was, in his opinion, only an infinitesimal opening for men chemically trained in bleaching and dyeing, as all experimental work was carried out by experts in the laboratories of the suppliers in Bombay. Mr. Wadia did not consider there was any opening at present for the employment of men with engineering degrees in mechanical, electrical or textile engineering.

Note from Captain Walter Lumsden, C.V.O., R.N., Director of Royal Indian Marine.

111. With reference to your interview of 23rd February 1912, I have the honour to offer the following remarks with regard to the employment of technically-trained Indians.

Experience gained in this Dockyard, from the employment of students who have completed a four years' course at one of the technical institutes in India, goes to show that, as practical workmen, they cannot compete with an apprentice who has served his time either here or at a general engineering shop; and this is to be expected, as a student at the Victoria Jubilee Institute would only put in as many hours at practical work, during his full course, as an apprentice here would do in one year, as the latter usually completes five years, before considering himself a journeyman, while admitting that the students gain more general knowledge in the theory of mechanics than the apprentice outside, the latter has a far better chance of early employment as a workman; he has been taught one trade, while the student's course embraces "general use of wood-turning tools," "pattern-making," "moulding," "smith's work," "turning and machine work," "fitting and testing."

At present there are employed in the engineering factory of this Dockyard two students from Poona and three students from Bombay.

They are willing and making good progress at their work, but as wage-earning mechanics, they cannot be compared with apprentices turned out here. The Poona students receive R1 per day in consideration of their leaving their own district, a fair wage would be 8 to 12 annas.

At a recent examination, held under the Bombay Boiler Commission, for 3rd Class Engineer certificates, several students presented themselves for examination and failed to qualify, the failure in each case was in practical knowledge of a most elementary character; apprentices trained here usually pass this examination at the first attempt.

What is required in the Government dockyards, mills, railway shops and general engineering works in India are skilled workmen—the posts of foremen, managers and technical teachers are few. I am of opinion that the institutes would find a better outlet for their students were they instructed more on the lines of apprentices in the home Dockyards. An apprentice starts work in the shops between the age of 14 or 16 attending the Dockyard schools, two afternoons and three evenings in each week, and for the rest of the time works the same hours as an ordinary mechanic. At the end of the first year the youths who show sufficient progress at school are allowed to continue attending for two years and similarly for a third year; a small percentage who show exceptional ability continue at school for the full five years. Few, if any, of these apprentices find difficulty in obtaining employment when their five years are completed, either with private firms or in Government service.

If a student from a technical institute after four years were to engage himself as an Improver in the Government Dockyards, Port Trust Workshops, Arsenals or a good general engineer work or railway shop for two years, I think he would be in a position to hold his own for employment in the skilled labour market.

A scheme is now being tried by Government for the employment of native artificers in the Royal Indian Marine for service afloat. If adopted, they would commence on R60 per mensem with rations, with a prospect of reaching R150, and at the same time enjoy the benefits of leave and pension rules.

There is no reason why students after working as suggested should not fill these posts.

Note by the Hon'ble Mr. H. V. Kemball, Joint Secretary to Government, Bombay.

112. It is not quite correct to say that I have found difficulty in getting good men to take charge of small pumping plants. I have inspected many installations of pumping plant for town water-supplies, but the only efficient engineer I found was the man at Hyderabad, Sind. I have not carefully inspected the plant at Sholapur. When I was there I had a very limited time at my disposal and was more interested in other questions connected with the water-supply. But I saw nothing which would lead me to think that the engineer in charge of the plant was not competent. The other men I saw were not competent as their plant showed.

I was only a short time in the post of Sanitary Engineer, and the engineers in charge of the pumping plant were appointed by the Municipalities and not by me. I got Government to accept the principle that, where Government assistance had been given to the installation of the water-supply, Government had a right to insist on efficient working. I then considered how it might be possible to get an efficient staff to take charge of the pumping plant and arranged for the inspection of the plant by a competent mechanical engineer. I was advised that the men in charge were almost all incompetent, that the men from the technical colleges were not to be trusted in charge of plant. I understood that there is a great opening for power-plant in this Presidency, and that the men in charge of such as exist are not satisfactory. I was advised that it was impossible to turn out competent men for the purpose I had in view without apprenticeship or training in commercial shops, that pump manufacturing shops were preferable, but that any commercial shops would suffice, and that there

would be much difficulty in inducing commercial firms in Bombay to take apprentices. I asked one firm and did not receive much encouragement.

I then induced Government to apply to the Secretary of State for the services of a competent and able mechanical engineer, with two objects---to inspect working plant and ensure that they should be worked efficiently, and to advise in the training of competent men to take charge of the plant, *i.e.*, the training of competent mechanical engineers. This necessarily included the apprenticeship in commercial workshops in Bombay, and I did not think fit to take further steps in forcing this apprenticeship until the arrival of the expert adviser. I was convinced of the necessity for this apprenticeship, and was very pleased to hear of the excellent work done in this line by Lieut.-Colonel Atkinson. I prefer to leave this question until the arrival of the expert adviser of whom I have spoken. I would prefer that no time should be lost, and will be glad to assist to the extent of my power.

I further said that it was essential that the pumping plant should be economically worked, because the assistance given by Government was calculated at the amount necessary to supplement the resources of the Municipality, and any shortening of the life of the plant, or increased cost of working, vitiated that calculation and tended to deter Municipalities from taking up sanitary works. The importance of this justified, in my opinion, the payment of very considerable salaries to competent men, who should preferably be Indians.

I wish to say emphatically that I appreciate highly the work which has been done by Lieut.-Colonel Atkinson in the line which I have been led to consider essential, that I will do my best to assist any attempts at similar work in this Presidency, and that I hope to be better able to assist when our mechanical engineer arrives from England.

I gave my opinion, that the upper and lower subordinates in this Presidency are good men, and that I had no fault to find with their training. I believe it to be impossible to give in schools all the practical training that is wanted. I maintain, that all that can be done in schools, is to teach the boys how and where to learn, to observe, to think, and to rely on themselves. The rest, and not the least important part of the training, must be done by the boys themselves and the men they work under. In my experience the boys who are placed under good men turn out good men. I fully agree with Mr. Hill that a good practical leveller must have had practice as well as, and after, school teaching.

Messrs. Greaves, Cotton & Co.

113. We interviewed Mr. Herbert Greaves, the Managing Agent, Mr. Sheppard, the Superintendent, and Mr. Broadley, the Superintending Engineer. There are large cotton mills in the compound employing some 10,000 men. Mr. Sheppard and Mr. Broadley were of the opinion that technical education was a mistake, any man once technically educated got "a bone in his back" that he would not stoop to dirty work. In their opinion a practical man could only be turned out by working in a mill, picking up what education might be necessary in a night school, though they owned that this system was impossible in this country. Mr. Sheppard was of the opinion a man should be trained either in spinning or weaving, but not in both. Mr. Greaves, however, was of the opinion that for good men technically educated, if they were ready to do an apprenticeship on a living wage after their technical school education, there were numerous openings and promised that trial should be given to such men. It seems, however, that it would not be wise to send apprentices to these mills while the actual gentlemen in charge are so antagonistic to technical education, however sympathetic the attitude of the Managing Agent may be.

Note from the Manager and Engineer to Messrs. Greaves, Cotton & Co.

With reference to the notes taken by Lieutenant-Colonel E. H. deV. Atkinson, R.E., and Tom S. Dawson, Esq., J.P., at the recent interview we

had with them, we beg to state we are not antagonistic to technical education in the sense these gentlemen would have you believe. What we objected to was having to pay apprentices a living wage whilst learning the practical part of the trade. Our opinion is that the practical and technical should, if possible, be learnt at the same time, that is, practical learnt at work during the day and technical in the evening after work, but as these gentlemen say this is impossible (we did not say so), then the practical part should be taken first and the technical after, for if the technical be taken first, the majority of boys who are then anywhere between 18 and 21 years of age, have a great idea of their own importance, and in some cases think they know all there is to be learned, and when they come to the practical part imagine it lowers their dignity having to soil their hands, and this is what was meant (and we said so at the time) that some technical students have " a bone in their back " and do not like doing dirty work. A student leaving school at 21 years of age and over does not like junior work because he thinks he is a full-blown journeyman having got a school certificate.

In the case of a student going in for engineering he works in a mill or workshop for twelve months and is then entitled to sit for the second class Boiler Act certificate: if he passes he seeks more remunerative employment. I am sure these gentlemen will admit that it is not possible for these students to learn the practical side of their trade in twelve months, yet they are entitled to take charge of engines and boilers—do you wonder which class of men employers prefer?

To show there must be some mistake about our being antagonistic we have at present in our mills eight youths, six from the technical school, Bombay, one from Roorkee school, and another ,a Mahomedan, who has got certificates from both the Manchester and Blackburn technical schools. These young men are working in our mills, yet when asked the practical side of their work they are lost. We gave Mr. Greaves a test of this, bringing the youth from Roorkee into the office and when asked a few practical questions, in fact the very rudiments of cotton-spinning, he did not know them. You saw the only question he could answer was the direction of motion of cylinder and doffer. Now this boy was three years at Roorkee and holds a City Guilds certificate, was recommended to us by Mr. Cullen, a late member of the staff, at the above school. Of course, they are fairly well up in theory and do know the three R's that is why they are employed by us—Jobbers and Muccadums are excellent practical men, but do not know calculations, etc. If Government followed our opinion by holding the classes at night to give the student a chance in practical work at mills during the day, and our muccadums and work-people a chance of learning theory, calculation and English at night, it would benefit both the technical students and the mill owners.

Messrs. G. Gahagan & Co.

114. We interviewed Mr. G. Gahagan, the senior partner, and Mr. G. W. Murray, the manager. Both these gentlemen were of the opinion that there were many openings for suitably trained Indians, and they would be glad to give a trial to some of these men and pay them a reasonable wage. They were both certain that men with technical training would in the long run prove most valuable.

Mr. Murray spoke of his difficulty in obtaining draftsmen, and said that a man who took up this work seriously would have no difficulty in getting work at ₹120 or ₹150 per month.

Messrs. Garlick & Co.

115. We interviewed the manager who stated that they took apprentices in their works and did not find many of these satisfactory, the difficulty being that after working a few months these apprentices left them and got employment elsewhere. They would be glad to have apprentices who had been technically trained, and pay them the same wages as they started their ordinary apprentices on, *viz.*, annas 4 per day. The manager stated that although technically-trained

men would be worth more than this, without sanction from his directors he could not increase this sum. There does not appear to be much opening for students with this firm.

Messrs. Sir V. Thakersey & Co.

116. This firm are agents for four mills. We had an interview at which the following gentlemen were present :—Sorabji D. Ghaswalla, Esq., Weaving Master; Pirojshah K. Mistry, Esq., Weaving Master; Khurshedji H. Bharucha, Esq., Weaving Master; Dadabhai R. Madan, Esq., Spinning and Carding Master; Mr. Dixon, Spinning and Carding Master; Dinshaw M. Hakim, Esq., Spinning and Carding Master; M. M. Mehta, Esq., Engineer; Hormasji N. Gotla, Esq., Engineer; Darabshah B. Mehta, Esq., Engineer; Manaji H. Kudwa, Esq., Weaving Master; G. Sutherland, Esq., Indian Mill; and W. G. Allanson Esq., Indian Mill.

A certain number of these gentlemen were antagonistic to technical education in the mill industry, considering that men who were at practical work in the mills should pick up their theoretical training side by side with it. They, however, considered night schools impossible in India. In their experience men from technical institutes would not take off their coats and work. If, however, students were sent from a technical school who would come for a two years' apprenticeship, and be ready not only to do any work given them but to conform to mill hours, they considered they would turn out valuable men and would be prepared to give them apprenticeships. Training in a technical school should be confined either to spinning or to weaving and the two courses should not be combined.

There were no openings at present for more highly educated men. Sir Vithaldas Thakersey was of the opinion that an apprenticeship of at least two years was absolutely necessary; and further, that not only should the technical school not grant any certificate till this was completed, but should hold an examination at the end of the apprenticeship to ensure that the apprentice kept up his theoretical work.

Messrs. David Sassoon & Co., Ltd.

117. We had an interview with Mr. Aspden, who superintends two cotton mills and one silk mill.

In Mr. Aspden's opinion students from technical schools would never get on in mills even if they were taken on as apprentices after their school careers. They would not really work and the caste question came in largely. The only right method was to give theoretical training alongside of the practical work in the mill. But mills could not do this. The same difficulty arose many years ago in England where the students from day technical institutes were not a success, and the successful men came from the practical mill workers who attended night schools. He, however, owned that these were impossible in India. In his opinion the jobbers ruled the mills, as labour-supply was a difficulty and jobbers could bring workmen; they, as a rule, objected to technically-trained apprentices. The Parsees, however, had a good chance in mills owing to their knowledge of the language, and to the fact that men of their own race owned many mills. Unless the jobber could be educated there was little chance of improvement in the ranks of employees. The jobber was, however, as a rule, an uneducated man and not fit to attend a technical school. Mr. Aspden advocated the formation of an afternoon school, where smart selected jobbers could be sent for theoretical instruction twice a week for a couple of hours. The instruction should be in the vernacular and the demonstrations be of a practical character.

He was, however, quite prepared to take apprentices, and recommended that at the expiry of their apprenticeships they should return to their school for a finishing course, or undergo an examination before being given a final certificate. This could be arranged by making them bound apprentices, and

including these conditions in their indentures. There were great difficulties in the way of the apprentice returning to his school for a finishing course as he would probably lose his job in the mill.

Mr. Aspden considered there were no openings and would not be for many years for highly technically educated men, but it was most necessary at present to go slow. He considered State scholarships to England or America absolutely ruined an Indian. In his experience these men, on their return, know little of their work, were mostly useless and too big for any position that could be offered to them.

Messrs. Morarji Goculdas Spinning & Engineering Co., Ltd.

118. This Company controls two mills. We interviewed Mr. Baptista, one of the managers, and Mr. Watcha, the General Secretary. Mr. Baptista considered an apprenticeship absolutely necessary for a student passing out of a technical institute, and the difficulty was to get mills to give it. Their Company was always willing to do so. Care should be taken to go into the figures of employment available. There were about 200 cotton mills in India and from 800 to 1,000 appointments available. For these posts men were recruited from England, from trained jobbers, from apprentices trained at the mills and from technical schools, so that the outturn from the latter should be carefully worked out so as not to overstock the market.

There was at present a scarcity of skilled labour, so the jobber was the most important man in the mill. He got from R60 to R70 a month and worked 12 hours a day. The educated student, as a rule, did not care to do this, and as in Mr. Baptista's opinion, Indians were fond of ease and did not really care for the hard work in a mill owing to the long hours and discipline, they generally turned off into some more congenial work, if they could find any that would give them a livelihood. He did not think jobbers would take to afternoon classes as proposed by Mr. Aspden. He considered the courses in technical schools in spinning and weaving should be absolutely separate, and a man should take up one and be trained thoroughly in that one branch.

He did not think the country was yet developed enough for education of a high technical standard.

Mr. Baptista and Mr. Watcha disapproved of men being sent to England to learn industries.

The Great Indian Peninsula Railway.

119. We had an interview with the officials of this Railway at which were present—Major H. A. L. Hepper, R.E., Agent; Mr. V. D. Bonner, Loco. Superintendent; Mr. F. J. Preston, Chief Engineer; Mr. I. W. Stokes, Signal Engineer; and Mr. A. N. Dixey, Electrical Engineer.

Mr. Preston stated that there were plenty of openings for good men for civil engineering work, particularly for estimaters; he found it difficult to get really good men, and his experience with them had not been a satisfactory one. He would be glad to engage men as opportunity offered, but could not guarantee any appointments.

Mr. Bonner complained that technically-trained men had a rooted objection to work in the majority of instances and wanted a cooly to assist them when such help was not necessary. He thought that the "Improvers'" scheme would give a far better result, and would be prepared to take a certain number of students for such training, but could not guarantee to employ them after their training was completed. Mr. Bell agreed with the remarks made by Mr. Bonner and would also be agreeable to take Improvers; he also said that there was great difficulty in obtaining draftsmen, who had any originality of ideas, and if such men could be obtained he would pay them R120 to R150 per month if they proved satisfactory.

Mr. Dixey stated he did not want any apprentices of the Improver Class and had no work at present except for fitters. In his opinion a boy who was

taking up work of the character he wanted, *i.e.*, signal engineering, should first of all do some practical work and then do his technical training.

With regard to the Permanent-way inspectors Mr. Preston said he could get crowds of men for this work, but admitted they were not of a satisfactory character; their principal men came from England, and they must do so for some time as the average man in this country could not be depended on to any great extent for important work.

The question of educating men by the Railway Company themselves was discussed, and it was admitted that the efforts they had made in giving technical training to their apprentices had not been successful, and it was generally admitted that such training could be carried out more efficiently in a properly equipped technical institute.

If a class for training Permanent-way inspectors was started they would probably nominate their own students who would be sons of their present employees.

The question of night classes was discussed, and it was considered that such classes would not be a success in this country.

The opinion of the gentlemen present was that there were absolutely no openings for the employment of men with a high theoretical training except in the civil engineering branch.

The Bombay, Baroda and Central India Railway.

120. We had an interview with the officers of this Railway, *viz.*— Mr. R. Woollcombe, Agent; Mr. R. Todd, Deputy Agent; Mr. F. J. Page, Loco. Superintendent; Mr. R. E. Pigott, C.I.E., Chief Electrical Engineer; and Mr. W. H. Wolff, Chief Engineer.

Mr. Page stated that he did not require men with a very high technical training as it was found that they were not generally prepared to stick to the work demanded of them. What they did require was good fitters with elementary technical knowledge who would be content to work themselves up to the position of chargemen when they could command a salary of ₹210 a month in the case of Europeans, and ₹105 in the case of Parsees, Goanese and other Indians.

At present the technical institutions were not turning out the men they wanted as they had no openings for men with a high grade of technical education. They would be willing to take men on the lines of the "Improver Class" suggested, but would not guarantee to employ them after their training was completed.

He suggested that elementary classes should be started for the railway apprentices, such classes to run side by side with the workshop training.

Mr. Pigott stated that he was employing about a dozen students who had been trained in electrical engineering. At the start, these men all said they knew everything but after they had disabused their minds of this idea and had been on probation for from nine months to a year, they showed promise of making good telegraph and block maintenance inspectors. Mr. Pigott said the students would be much more useful to him if they had been instructed in telegraphy and telephony, and know how to signal at the rate of 16 words a minute. He promised to discuss the matter further with the Principal of the Victoria Jubilee Technical Institute.

Raipur Manufacturing Company, Ahmedabad.

121. We interviewed Mr. Lalbhai Dalpatbhai, the agent, and the manager of this mill.

These gentlemen were much in favour of the scheme for giving practical training to men after their technical course, and promised to help in every way they could; both felt sure that the result would be worth the trouble taken. They had some experience of technically-trained men, and found them rather a difficulty in the beginning, owing to their desire to simply order, and not to work themselves, but admitted the men were capable and useful when once they got into the methods of the mill. They did not think a class for jobbers

would be of any use, but thought it would be a good idea to select the sons of jobbers for training, as these men when educated would be able to fill posts in the mill, at present occupied by men of a very inferior type as regards technical knowledge.

Ahmedabad Spinning and Weaving Company.

122. We visited the Ahmedabad Spinning and Weaving Company and interviewed the managing agent, Sir Chinabhai Madhowlal, who also controls the Ahmedabad Ginning and Manufacturing Company.

Sir Chinabhai said that there were many openings for a better class of fitters and erectors, and it was hoped that the Ahmedabad Technical School would ultimately turn out a class of men to fill these vacancies. He thought that the scheme of education at present attempted in this school was far too ambitious, and was not in accordance with the ideas of training originally decided on, which were to train men in textile work, with a sufficient knowledge of engineering, to enable them to do their own erecting and repairs, and also to train up men as fitters and erectors. He stated that he had as a member of the Managing Committee, disagreed with the Principal over the syllabus, which was far too advanced in character for the present staff to carry out, and also that the equipment in physics and chemistry was not sufficient to do any real work with.

What was wanted was a good sound practically educated man, and provided that men can be turned out of the school of this type, he would be glad to take them on as Improvers in his mills.

He also said that the courses of instruction in spinning and weaving should be kept distinct, and approved of the idea of selecting men from the mills to go for training to the technical school.

His opinion was that no opening for employment of a highly educated man in mechanical or electrical engineering was at present available, or likely to be for many years to come.

Gujarat Spinning and Weaving Co., Ahmedabad.

123. We visited the Gujarat Spinning and Weaving Coy.'s Agents, Messrs. Jamabhai Mensukhbai, who also control two other large mills. Mr. H. B. Hatiram, the manager, stated he had no fault to find with technically-trained students, except that they lacked the practical knowledge of the mill, they did well after they had had it. He would be glad to take some students for training on the apprentice system, and give them all the help possible, and he felt sure that if the proper type of man could be got, he would amply repay the mill authorities for any trouble which might have to be taken with them at the start. He said that the training being given in the Ahmedabad Technical School was useless, and the character of instruction must be altered. He suggested that if this school confined itself to teaching young men actually employed in mills who should attend the mills for half the day, and the school for the remainder, he would send some of his smart men for such training. In his opinion, the courses in spinning and weaving should be kept entirely separate. He had room for men with a good chemical training in the sizing and bleaching departments.

Ahmedabad Calico Printing Co. and Jubilee Mills.

124. We interviewed Mr. Ambarlal Sarabhai who controls the Ahmedabad Calico Printing Co. and the Jubilee Mills.

Mr. Sarabhai stated that there was a great demand for good technically-trained students, and he would be glad to give employment to such men, there was need for a class of engineers with a better knowledge of fitting and turning, who would be able to execute their own repairs and adjustments, and who would insist on their machinery being kept in a high state of efficiency. He referred to the Boiler Act examinations, and stated that, in his opinion, this

examination did not exercise a useful effect, and suggested that a training similar to that required for a Board of Trade Marine Engineer's certificate be insisted on. So far as his experience was concerned the men trained at the Kala Bhawan Technical School, Baroda, were of a useless type and incapable of doing any work such as employers demanded. He said there was a demand for men with a good training as finishers, dyers, sizers and bleachers, and he would prefer men who had a sound chemical knowledge as well as a practical one for this purpose; he had to pay ₹600 per month for a man to do this work, and could find employment for several men who had suitable technical training with some practical work in a mill in addition. He would be glad to take some Improvers and thought that such men would ultimately turn out most useful.

The Maneklal Hiralal Spinning & Weaving Co., Ahmedabad.

125. We interviewed the managing agent, who stated that technical education should be made as practical as possible, and that students should be made to work longer hours in the schools, the technical students they had had were clever enough in their way, but objected to doing any practical work.

He approved of students being sent to mills for their practical work, and would help in the scheme, but was afraid that mill managers, etc., would not help much, as they expected to be paid for teaching. He suggested that the Millowners Association should take up the matter, because if they were all of one opinion the managers would be obliged to help. He approved of the scheme for educating jobbers, and said that the Ahmedabad Technical Institute was supposed to be training this class of man.

If a school for jobbers was started he would have no objection to sending some of his men, and suggested giving prizes to encourage them. He thought there were no openings for the highly trained electrical and mechanical engineer. The manager of this mill had had some training in the Victoria Jubilee Technical Institute in Bombay and had worked his way up to his present position, stated that there were 10 or 12 men from this Institute who were all in good positions in Ahmedabad.

Technical School, Ahmedabad.

126. This school was instituted to train fitters and jobbers for the textile industry. It possesses an excellent textile plant, which, however, is spoilt by the absence of some most essential machines.

The school also possesses an excellent workshop, well adapted to turn out fitters and jobbers, but the aim of the education given has been altered, and the object now is apparently to turn out textile experts and mechanical engineers. The syllabus is far too ambitious, and the school does not possess the staff or laboratory equipment, to carry on the syllabus in any way.

No classes have yet been passed out, but everything points to failure, whereas if the original intentions were adhered to of a textile industrial school, there is every reason to believe it would be successful. In addition to training textile fitters and jobbers, classes might be held in the vernacular for the instruction of workmen already engaged in the industry.

Tata Sons & Co.

127. Your favour of the 11th instant has been received. We are sorry the note regarding our interview on technical education was not sent in earlier.

Our Mr. Saklatvala, as arranged, visited the Victoria Jubilee Technical Institute, where, by the courtesy of the Principal and Professors, he was shown round almost all the departments. He has been favourably impressed with all he saw, and acknowledges that everything is done as far as is possible to impart a thorough theoretical and practical training to the students in the different lines selected by them.

At the interview, all of us, we understand, agreed on the point that for the technical school student to qualify in time for a responsible post it was quite essential that he should after his full course of three years at the school serve a further apprenticeship of at least two, and preferably three, years at any mills.

As to whether we ourselves would take up such students on a living wage at our mills, we must say that having already our own system of taking apprentices we are not in a position to make a definite promise. We do not take up every year a fixed number of apprentices, graduates or ordinary, but we do so only when vacancies occur, or a special occasion arises.

We should very much like to try the experiment of taking up as apprentices a few passed students of the institute, giving them better terms than what we ordinarily allow to our own apprentices, but as pointed out by our Nagpore Mills manager, Sir Bazonji Dadabhai, at his interview with you, we are afraid it may have a discouraging effect on our own apprentices. In other mills where there is no apprenticeship system like ours this difficulty will not be felt, and there will be larger field for the students, and we believe the mills themselves would find it to their advantage to have as apprentices trained students of a well managed technical institute.

Although as stated above we are handicapped in the matter of taking up the institute students as freely as we could have wished, we would state that the efforts of the institute have our full sympathy, and we are even prepared to go out of our way to some extent by taking up a couple of students on special terms when occasion arises. In fact, since the interview, our Svadeshi Mills have taken up on special terms a Poona College of Science student on the recommendation of Mr. Allen.

We shall, moreover, be glad to co-operate with you as far as possible in any scheme which you may propose.

CHAPTER XI.—MADRAS.

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Kolar Gold Fields.

128. We visited these fields and interviewed the Secretary and some of the members of the Mining Board. There seems very little opportunity for the employment of technically-trained Indians here. The industry is so great, the interests involved so enormous and the risk to human life so constant unless the most efficient control is applied, that all the superior posts must be occupied by men who have had a life-time's training. From the following outline of the organisation of departments it will be seen that there is little opening for Indians except as artisans :—

Departments on the Kolar Gold Fields.

Mining—
- Supervision, Europeans.
- Timbermen, ,,
- Surveyors, ,,
- Timbering Mistries, Indians.
- Contractors and drivers, Indians.
- Unskilled labour, ,,

Engineering—
- Supervision, Europeans.
- Boiler-smith, ,,
- Blacksmith, ,,
- Fitter Foreman ,,
- Drivers ,,
- Draftsman, Indians.
- Fitters, ,,
- Blacksmiths, ,,
- Unskilled labour, ,,

Reduction—
- Chemists, Europeans.
- Amalgamators, ,,
- Millmen, ,,
- Foremen, ,,
- Unskilled labour, Indians.

C. A. Smith, Esq., Chief Engineer, P. W. D.

129. Mr. Smith thought that the civil engineers from the Madras Engineering College showed great weakness in their practical work, but appeared all right so far as theoretical training was concerned. He thought greater attention should be given to the practical part of civil engineering. In his experience all the men he had employed required to have a good deal of practical education given to them before they could do any useful work. He was not very satisfied with the majority of the men he had had, but thought the weakness was due to the men themselves, and not to the college training. Mr. Smith also said there was a great demand for draftsmen which was not being provided for.

Mr. A. Chatterton, Superintendent of Pumping and Boring.

130. We had an interview with Mr. Chatterton who stated that although the natural resources of the Madras Presidency preclude the possibility of industrial development on a large scale, there is evidence that in future there will be a considerable demand for the services of a superior class of mechanic to supervise the working of a large amount of labour-saving machinery, which will be employed to prepare agricultural products for the market. This includes a number of rice mills, irrigation plant, cotton-presses and gins. The class of man required can hardly be classed under the term technically-trained, as the requirement is really an intelligent and skilled mechanic, the salaries offered being fairly low. In the factories and workshops of Madras, there is a demand for moulders, pattern-makers, fitters and turners, smiths and general machine-men and the supply is at present inadequate. In the districts there is equally a demand for engine drivers and foremen-erectors, and for men capable of doing miscellaneous repair and maintenance work. A committee has recently forwarded to the Government of Madras a scheme to meet this demand on the following lines:—

1. That it is desirable to establish a system of State apprentices among the engineering shops in the North of Madras.
2. That it is necessary to make some provision for technical training in a school outside the workshops.
3. That instruction be given in the school to each boy on three days a week in the afternoon.
4. That the instruction be given in English, and that the boys should possess such educational qualification as should enable them to take advantage of it.
5. That a fee should be charged to all apprentices.

P. T. Lee Chengalvaroya Naicker's Technical and Industrial Institute and Orphanage.

131. The Institute teaches civil and mechanical engineering and generally prepares for the Government technical examinations.

Civil engineering is taught up to the sub-overseer grade, and 25 students are admitted yearly, but only ten to twelve usually pass. The survey equipment consists of three levels, three plane-tables, three prismatic compasses and one theodolite.

The workshop is fairly well equipped, but there are no laboratory appliances for teaching.

There is an oil engine-drivers' class, which was transferred by Government from the School of Arts to train students for the numerous small pumping installations introduced in the agricultural department. These men go out on a salary of ₹15 a month, but it is found the agriculturist finds this salary a heavy item, and after two or three months one of the more intelligent picks up sufficient knowledge to run the engine and the student is dismissed. The industrial part of the education given to students in weaving and carpentry seemed to be excellent.

College of Engineering, Madras.

132. We were shown over the College by the Principal, Mr. James. The classes established are an engineering, an upper subordinate and a lower subordinate class in civil engineering, and a class in mechanical engineering of the engineer class standard. The latter class is just completing its first course for the first time and will shortly turn out six men. Mr. James was doubtful what opening there would be for the employment of these men. The other classes prepare entirely for the Madras Public Works Department, Revenue Department, Local Boards and Municipalities. An average of 11 engineers, 23 upper subordinates and 31 lower subordinates have obtained appointments in these services during the last seven years. The College is poorly equipped with laboratories and workshops, but there is a scheme on foot for a new college to be built near Guindy at a cost of 13 lakhs, which when completed should meet every demand.

Messrs. Oakes & Co.

133. We had an interview with Mr. Oakes and Mr. Tweedy, the general manager, engineering branches. Mr. Tweedy was of the opinion that there was little opening in Madras for the technically-educated Indian, but an improved class of mechanic was much wanted. In his opinion it was best to get a trained workman, and give him a technical education to suit his needs, but this was a difficult, if not an impossible, proposition in India. He approved of an apprentice system of the improver grade, but there was little opening for these men in Madras. Mr. Oakes was of the opinion that firms could do much more for the training of Indians if Government would give them more work.

South India Industrials Co., Ltd.

134. We interviewed Mr. Haji Ismail Sait, the managing director, who stated there were many openings for men with a good technical and practical training in engineering works, sugar and cement works, jute mills, rice mills, etc.

He approved of the apprenticeship scheme, and promised to give it his support. He also stated that there was a great difficulty in obtaining a good motor mechanic in Madras, and he had offered ₹150 a month for a mechanic driver and could not get one who was of any use.

Messrs. Binny & Co., Ltd.

135. We visited Messrs. Binny & Co., Ltd., who are agents for cotton mills, the Madras Electric Supply Co., and other undertakings, and employ altogether about 10,000 men. We interviewed Mr. Simpson, the manager, Mr. Jackson, the head chemist, and Mr. St. John, the manager of the Electric Supply Company.

Mr. Simpson stated that one of the chief difficulties of employing technically-trained Indians in factories was their disinclination to face the long hours of work. Discipline and regularity were as necessary in a factory as in a Government department, and men employed must conform to factory practices and face up to the long hours. In his opinion technical institutions should train their men to commence work at 6 A.M. and to work actually nine hours at least daily. He also believed in forming classes for the training of operatives engaged in factories. Pioneers of labour in England have mostly risen from the working classes. The intelligent working man who wants to get on knows exactly what he wants to learn. The student seldom knows what will be of use to him and so spends much time in learning that which is afterwards of small value. In brief, work should go on at both ends, the educated man should be taught to use his hands, and the operative have an opportunity of learning to use his head.

Mr. Simpson also explained the system they had started for educating the work-people of their mills. He said that they were quite prepared to pay an instructor to teach the theory of textile work, but thought that as the authorities were doing so much for technical education they might assist by giving a man to take up this work. He would be prepared to take students on the apprentice system and could probably find room for six annually.

Mr. Jackson stated there was room for technically-trained students for bleaching, sizing and dyeing, and would consider before he could recommend the mills to take apprentices, as he found that men simply came for a short time and gathered all the information they could about the various processes, and then cleared off to trade with this information at some other mill.

There was a want of mechanics in the dye house, and they would be glad to get men for this work.

Mr. St. John stated he had no difficulty in obtaining men with the requisite knowledge who with a little practical training soon became useful. He had several men who had been trained at the Victoria Jubilee Technical Institute, Bombay, and he found these men good up to a certain point; one man was very smart.

Mr. St. John said he did not know what employment a highly trained Indian mechanical or electrical engineer could obtain.

Madras and Southern Mahratta Railway.

136. We interviewed Mr. A. B. Strange, Chief Engineer; Mr. H. H. L. Prendergast, Electrical Engineer; and Mr. R. G. Bamford, Loco. Superintendent.

With reference to the training of Permanent-way Inspectors, Mr. Strange stated that he had not been satisfied with men of the overseer class whom he had tried, but would be glad to take one or two of this class provided that the College of Engineering, Madras, would give them a special training.

At present they selected their men by holding examinations and had no difficulty in meeting the demand for permanent-way inspectors. The scheme proposed for training permanent-way inspectors was outlined, and Mr. Strange expressed his approval of the idea, and liked the idea of being able to nominate his own men, and probably would be able to arrange for some support being given to the nominated students while undergoing their technical course.

Mr. Pendergast stated that there were a few openings for signal fitters who had some electrical training and also for telegraph inspectors, but that so far as his railway was concerned, they had no openings in general electrical work, their installation being small.

Mr. Bamford said that at present they trained up their own apprentices, but would have no objection to taking technically-trained students for their apprenticeship and to pay them the same rates as were paid to their own men.

Sir Francis Spring, K.C.I.E., Chairman of the Port Trust, Madras.

137. We had an interview with Sir Francis Spring, who was of the opinion that there was not much hope in Madras for the establishment of industries requiring the employment of technically trained Indians of the better classes, until Indians had learnt to inspire commercial confidence in each other. There was little opening at present for Indians with a high technical training in Madras, but there was a great and increasing demand for skilled artisans, such as fitters, plumbers, electricians, etc., in connection with improved sanitation, electric enterprise and motor vehicles. The Eurasian, of whom in Madras there are great numbers of the artisan class, is content with small earnings, and is more generally useful than the educated Indian because of his greater freedom from caste restrictions. But many native casteless artisans are excellent and reliable workmen. These men, however, need the guidance at present of Europeans because the educated Indians, as a class, refuse to qualify themselves for their leadership.

Sir Francis considered it wrong that the educational policy of the country should as it now is, be conducted almost wholly on literary lines. He did not believe, at this stage, in pushing on with the higher technical education of mere artisans—that might come later. What was wanted now was that there should be available for the better classes, an alternative course of education on technical lines, but so designed as not absolutely to cut off a youth who followed those lines from all hope of employment in the public service, if he should see fit, later, to prefer this to a career of industrialism—an education which, moreover, should at least give him a chance, if there were any industrial instincts in him, of finding out that he possessed them.

The wealth of a nation lies in her industrialism, and students should be taught to think of actual *things* and of their qualities, instead of merely of words, whether voiced, printed or written. Under the ordinary system of education bestowed on India by her rulers, it is, for the most part, *words* that are in question and not concrete *things* that can be handled, weighed, tested and broken. The consequence is that educated Indians, as a class, despise and avoid education on industrial lines, preferring the literary education which leads to Government employment. The result is an almost complete absence of industrial leaders of the educated class—at least in the South. This must be changed and the change will take time, but it must be a radical change if ever it is going to help the Indian educated classes to guide, direct, and govern the labour of mills and of factories, as in the Western world they are directed by the better educated.

Under present conditions in Madras, the young man of good family, who has arrived at the point of choosing a preparation for a career, looks around and sees all his older friends at the bar or in State or mercantile employment. But he is quite out of touch with industrialism, and he totally ignores the existence of the great railway workshops, the cement works, the cotton mills or the glass works because, except for a few poorly-paid clerks, none of his own class are mixed up with them. Then if he thinks at all he probably concludes that he and his friends, however well educated technically, have next to no chance of finding capital for independent ventures into industrialism, because none of the moneyed class of their own race has the smallest intention of risking money in their hands. He thought that the early germs of such commercial confidence might perhaps be found in the Co-operative Credit Societies the adoption of which as a popular institution had, in later years, made so marvellous an advance in the Southern Presidency ; but at present rich Indians will not, at least in the South, put their money into Indian-managed industries on a commercial scale.

Meanwhile, without thereby necessarily excluding them from the public service, we ought to make available, for young educated men, carefully designed courses of manual training, so that those who have in them the germs of an industrial bent may become aware of it, before they stiffen into a life of clerical routine.

E. P. Richards, Esq., Municipal Engineer, Madras.

138. Mr. Richards stated that the technically trained men he had employed, and who had had only technical training, and no experience, were almost valueless ; he found them of little or no use either for indoor or outdoor work. They had to be taught what to do. He also said that he found it always necessary to hold examinations himself for selecting his overseers, draftsmen, surveyors, and assistant engineers, as he could not rely on the certificates held. He had been badly misled by such certificates. For a recent appointment he had to make, he had examined 13 men selected from over 100 candidates and the results were most disappointing.

He said that the training in surveying, both for the overseers and sub-overseers, was insufficient and imperfect. Nor did they as a rule with few exceptions, know anything about such simple but essential matters as bond in brickwork, mortars, concretes, good and bad teak, use of boring rods and plumb-bobs and the usual knowledge expected of a clerk of works or overseers.

The chief want of City and Municipal engineers in India, as regards staff, were assistants with technical and practical training in municipal engineering. He strongly advocated the pupilship system, and prior college training on the lines of the examinations held in England by the Incorporated Association of Municipal and County Engineers, and by the Institution of Municipal Engineers.

Mr. Richards further added that every pupil in England, being trained to be an assistant engineer, is sent out of doors at first with a senior assistant, and later by himself, to make actual surveys and take actual levels for works. He has to take the chief part in setting up and reading the various instruments, and he holds the directing end of the chain himself, in chain surveys. All surveys and levels at home are done by the actual hands of junior engineers, and if very important by senior assistants helped by juniors.

A pupil is not allowed to draw until he can trace properly. He then begins to design little works, and details of large works, under the direct control of an assistant engineer. If he is intelligent, and in earnest, he is of some real use by the time his pupilship is finished, and has learnt much. He goes out with assistant engineers and looks at work in progress and learns all about timbering, excavation, tunnelling, brickwork and concrete in all their varieties, etc., etc., and generally he gets a sound idea of the ordinary every day operations of Civil Engineering.

The Indian College Graduate is firmly convinced that he can do *anything*, and knows *everything*, but set him to design some simple little work, and he will, 50 to 1, turn out an abortion.

CHAPTER XII.—THE UNITED PROVINCES.

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The Victoria Mills, Cawnpore.

139. We interviewed Mr. Atherton West, the manager, who stated that there were many openings in which a technically-trained student could make himself extremely useful, and if such a student came with a determination to succeed, and to make himself *indispensable*, he was in the end bound to come to the top.

Mr. West said that in every mill there was a demand for a better educated man, than could at present be obtained, a man who would notice things which were not working properly, and who would be able to insist on efficiency, and in his opinion a technically-trained man on the lines explained would be most useful and was wanted badly. Such a man could act as an intermediary between the manager of the department and his men, could help in any difficulties of workmen control, and would generally speaking be very useful, especially as an assistant to a new European overseer on account of his knowledge of languages, but a student who aspired to such a position must not imagine it would be given to him at once, there would be many things to learn first, and first of all the student must learn to make himself *indispensable*.

Mr. West also spoke of the openings which must ultimately come for technically-trained men as bleachers, sizers, dyers, finishers, printers, etc., and thought that these subjects should be taken up.

Mr. West did not approve of starting a class to educate "mistries," his idea was to have a school in his own mill and to take young promising lads and educate them, so that they might ultimately become "mistries;" he was going to build a school and try what could be done, and he hoped good would come of it, such a school might ultimately take in the best of the workmen but he did not propose to admit them at the start.

Mr. West was strong on the point of a separate course for weaving and spinning and would even divide up the latter if possible.

Mr. West's opinion of Industrial schools was that they did not and could not educate a workman, and that they could not help in the general scheme for improvement, the mills and workshops must educate and train the workmen, and the technical schools will supply the trained man for the higher positions.

Mr. West said that the technical education of the Indian should go slowly, and that he should be made to understand that his education is not finished when he comes from the school, and that his education is valueless to any employer until he has learned to apply his knowledge usefully.

Mr. West did not think it was the slightest use sending men to England, all the training needed could be given in this country, and he thought that sufficient consideration was not given to the condition which would arise when a number of these men were seeking employment without success.

Messrs. Frizzoni & Co., Cawnpore.

140. This firm employs a number of men of the overseer and sub-overseer class, to superintend work on building contracts, etc.

We found on enquiry they experienced considerable difficulty, in obtaining a good class of man for this work, and generally have to get a man from

the Public Works Department service, and induce him to take up their work by offering double pay.

They complained that the best men were all given Governmentap oi nt-ments, and that private firms like themselves had to take any men who were left out of this service.

This was, from their point of view, an unsatisfactory arrangement, and prevented them from getting men suitable for their work; as a result of this they had imported men from Germany and often found them unsuitable when they got them.

They also experience great difficulty, even when offering high wages; in obtaining the services of a good class of draftsmen, *i.e.*, men who not only can make a clean drawing but also know something of architecture and the constructive part of a building or can freely work from rough sketches.

They consider natives of a high (like University or Polytechnic) education unsuitable for engineering firms who work on commercial principles, but need men with practical and some theoretical knowledge and of honest character, who are ready to put their shoulder to the wheel and do not shrink from any rough work as so-called native gentlemen invariably do. If Indian technical schools can produce such men, they will always find ready and lucrative employment.

Mr. L. A. Parker, Inspector of Factories, United Provinces.

141. Mr. Parker explained that under the Act in force there were four grades of examinations for engineers, *viz.*, first and second class engineers, and first and second class engine drivers.

The mechanical apprentices from Roorkee all went for the engineer certificates in the end, and would not take up posts as engine drivers on the very low salaries offered. There was no proper training of a technical character in this province for the lower grades of engine drivers, who got their training usually in a most unsatisfactory manner as coolies, or firemen, in the engine houses of mills or factories.

The certificates of training these men produced were often open to grave suspicion. There were about 140 ginning factories in the provinces, which only run for 4 or 5 months each year, and the employers invariably took the cheapest man they could get irrespective of the grade of his certificates. They would not pay for trained firemen, but preferred to use coolies, and the installations in these factories were in a most inefficient state for this reason.

Till employers were educated to understand that a good engineer meant efficient working, and a saving in running costs, this state of things would continue, and at present there was little chance of remunerative employment for a properly trained engineer outside the big mills and factories.

Cawnpore Cotton Mills, Limited.

142. We interviewed Mr. D. Durie, the manager, who stated that he had four apprentices who had been technically trained, and found them all right up to a certain point.

His chief complaint was that these men all expected special treatment, and wanted to be placed on an entirely different footing to other apprentices.

They were generally speaking irregular in attendance and took leave whenever they thought fit.

Mr. Durie thought some good might be done by a class for educating the "mistries," but thought they would not take much advantage of it.

The men in the mills were paid on production, and it would mean a loss in wages if a man went to a school during working hours, and a night school would be out of the question.

Mr. Durie stated he would continue to take apprentices and give all the assistance he could to technical education.

Messrs. Begg, Sutherland & Co., Cawnpore.

143. We had an interview with Mr. A. D. Pickford, Begg, Sutherland & Co.; Mr. J. McGlashan, Cawnpore Sugar Works; Mr. P. G. Moore, Indian Electric Supply and Traction Co.; and Mr. A. P. Curtis, Indian Electric Supply and Traction Co.

The Electric Supply Company were taking apprentices from the mechanical apprentice class, Roorkee. Their chief difficulty was, that these men, after obtaining a little experience with them, were ready to leave and take up any job which offered an increase of salary. They usually worked well and made themselves useful, but if placed under an agreement with a rising salary, after doing well for a year or two, they began to slack off. The salaries offered were, however, nothing like those paid to similar men in Calcutta, where they commanded ₹100 upwards. The salaries paid in Cawnpore are nothing like this, and this fact may account for apprentices desiring to move to where higher salaries are paid.

Mr. McGlashan was strongly of the opinion that the class of mistries and fitters wanted improving. In the old days in Cawnpore, the European engineer had to work himself, and train his own men personally, and produced a really good class of fitters. This was seldom done now, and the Indian had not the chance of seeing his superior working, and of being trained in the same manner.

Mr. McGlashan was of the opinion that technical afternoon or evening classes would be of advantage for this type of man, but though his firm would permit their men to attend, it was fairly certain that the mills would not do so, so the suggestion was not practicable.

The staff of the enterprises controlled by Begg, Sutherland & Co., however, quite realized the difficulties the authorities of technical institutions had to deal with, and the inherent inaptitude of the Indian for industrial work, and were willing to help on the efforts being made, to the best of their power, by taking apprentices and looking after their training.

The Elgin Mills Co., Limited. Note by the Secretary.

144. I am duly in receipt of your letter of the 7th instant, enclosing a copy of notes taken at our recent interview, and have to say that in the main they correctly convey the views we hold, and endeavoured to express to you. I should like, however, to take the opportunity of enlarging on what I said, and I might remark that Mr. Vernon is also in agreement with me in what I am now writing.

The class of young men which the Thomason College is now recruiting appears to us to be totally unsuited to the needs of European millowners and managers. These young men are usually members of families of the Indian gentry, and as such are not altogether to be blamed for disliking the only class of work which we would be prepared to offer them as a start. We can obtain the services of English managers, spinners, weavers, fitters, engineers, etc., etc., members of the class which has produced workers in these trades for generations, and who not only have a certain amount of theoretical knowledge but have what is far more important, *practical* knowledge, at their disposal. I hardly think I need enlarge upon the fact that so long as we can obtain the services of this class, it would be merely an expensive experiment in philanthropy to replace them with Indians in the hope of achieving in one generation what it has taken at least a hundred years to do in England. We expect our overlookers and managers to be prepared at any time to take off their coats and remedy anything that may be wrong, with their own hands, equally as much as we expect them to be able to explain at once to the work-people the nature of any defect which may exist in the machinery under their charge.

We do not doubt that many of the young men turned out at Roorkee are fully qualified for the latter work, a knowledge of which can be acquired theoretically;

but it has not been our experience that they are qualified for the former. I quite understand that this latter knowledge can only be acquired in a mill, working commercially, and as I explained, we are always willing to take in a few of these youths and give them the opportunity of acquiring the practical knowledge which we consider to be essential, but our experience has been that they are not willing to take up this side of the profession seriously. We have had some 6 or 8 of them in the past, and none of them have been satisfactory, owing entirely to the fact that they come here expecting to have a job equal in position and pay to that occupied by our fully qualified European staff, with none of the responsibilities above referred to.

I should like to repeat once more that in my opinion it is impossible to train Indians in one generation either as textile experts or engineers (it is difficult enough to train them as mill workers), and for this reason I repeat my suggestion that the most likely way of finding suitable students for the courses which the College offer would be to start schools for the children of persons already employed as mill hands in a place like Cawnpore, where there is a class of hereditary mill workers growing up and now in the third and fourth generation. A selection of the most promising should be made from amongst these for further education at Roorkee, but I strongly deprecate giving any such youths an expensive western education at present. If it is the wish and intention of Government to assist millowners in this country by providing them with knowledgeable young men, it appears to me this is the best class to start upon, but if it is merely the wish of the Government to attempt to find careers for young men of good position who otherwise have no career available, I fear that in the majority of instances the class which falls under this heading will never turn into suitable recruits for European owned and managed mills. I do not think that any appreciable number of, what for the want of a better word, I must describe as hereditary gentry, are to be found in the ranks of the managers and overlookers in the mills in Lancashire, and I can see no reason to suppose that the gentry of this country would take to manufacturing pursuits any more readily than those in England.

I confirm our remarks as regards dyers, and would like to say that I consider they apply equally to any other trade.

The above remarks apply with even greater force to students who have been sent to Europe to complete their training. Such young men should not be led to expect to come back with an extensive list of degrees and nothing else to recommend them, and on the strength of these *only*, demand a position equal in pay and authority to those occupied by Europeans or Indians who have the far more useful qualification of practical knowledge of their work, not to speak of the confidence of those under them, and the ability to manage their labour.

The Muir Mills Co., Ld., Cawnpore.

145. We interviewed the Secretary, Mr. S. H. Ball, and Mr. A. Holden, the Manager.

Mr. Holden's opinion of the technically trained Indian was that he generally had too big ideas and would not work, but he had met with a number of men who had turned out really well, and he had thought that although the material to be educated was not of a very satisfactory character there was no need for the Educational authorities to feel discouraged. A better choice of students would eliminate most of the difficulties.

He said that the technically trained Indian starting life in a mill had tremendous difficulties to face, long hours, cotton sickness, and continual opposition from the uneducated men in minor authority.

Mr. Holden approved of a scheme of apprenticeship for students; he said afternoon classes might be successful, and there was no doubt they would do good if a suitable scheme could be arranged.

The Hathras Mills.

146. We had an interview at which Mr. J. Cullen, the manager, and the following gentlemen who are the owners of these mills were present:—Lala Harchandass, Lala Purshotam Dass, Lala Ramadyal, Lala Moti Ram, Lala Pyare Lal and Mr. I. M. Lawson.

These gentlemen were all of the opinion that it was no use giving technical education to men of high social position. Such men would not work, and it would be better to take lower class men, even if their education was of a lower standard, as they would turn out the best workers in the long run.

Mr. Cullen was in favour of an apprentice scheme, and would give it his support, and he felt sure that it would give good results. Mr. Lawson also said he would assist as far as possible. It was pointed out to the Indian gentlemen present that it was on their application the classes for the sons of millowners and capitalists was started at Roorkee, and that so far no students had availed themselves of the classes.

The opinion now obtained was that these men would not send their sons and relations, and that they would not as a rule work in the way which is necessary, even if they were sent.

They considered that the time for high or advanced technical training had not yet come for the Indian and that it often puts wrong ideas into the minds of the boys, who as a rule get entirely out of control of their parents.

Note by Indian Millowners of Hathras City named above.

147. With reference to our interview at Hathras, we beg to say that in our opinion, the majority of the millowners will not prefer to send their sons or relatives to the Technical College, as they do not like to work with ordinary labourers.

The boys of moderate positions, that is of middle class people, should be entered in the College, after they have taken reasonable education in the high school, so that they may be able to understand English sufficient for their course.

We think such boys will turn out good workmen after some time.

Messrs A. John & Co., Agra.

148. At this interview Mr. John had kindly arranged for his general Manager, Mr. Scott, the Engineer, Mr. Thornley, and the Mill Manager, Mr. Witham to be present.

These gentlemen were all in sympathy with technical education for Indians, and promised their support in any way in which it would be useful, and they would be glad to have these men in their mills, engine rooms, workshops, and to give them every opportunity, provided they were willing to work on equal terms with other workmen employed and did not expect to be put in positions of authority. Once they had gone through their practical training, their technical knowledge should undoubtedly enable them to obtain better positions and higher wages.

In referring to the generally expressed opinion that the educated Indian dislikes working with his hands or doing any dirty work, Mr. John stated that this defect did not exist in the Indian alone but that Europeans brought up in this country were sometimes equally bad.

Mr. John thought it would be useless to start advanced classes for the son of capitalists, etc., or in fact to take up any very advanced work at all, and in his opinion there were no posts open for Indians who had taken an engineerings course of the University standard, and he personally could not employ such men.

The Bengal and North Western Railway, Gorakpur.

149. We had an interview with the Agent, Mr. E. A. Neville, at which Mr. W. J. Turnbull, the Chief Engineer, Mr. W. Longmuir, Locomotive Superintendent, and Mr. J. R. Silver, Deputy Locomotive Superintendent, were present.

There do not appear to be many openings for technically trained Indians in this Railway except as draftsmen. The general opinion was that pure workmen were wanted, and their great difficulty was that they could not get enough; they did not think a night school for their men would be likely to do much good, and at present they could not get enough uneducated labour to be able to insist on education. They would be willing to take technical apprentices and thought it likely they would prove useful.

With regard to permanent-way inspectors it was admitted that their present method of training was not all that could be desired, and the scheme of education as proposed by Mr. Jellett they thought was suitable,[1] but they also thought it doubtful if they sent apprentices to be trained on these lines, if it would pay them, as such apprentices would probably, on completion of their course of training, leave them to join any other railway who might offer higher wages.

Oudh and Rohilkhand Railway Company, Lucknow.

150. We had an interview with the authorities of this Railway, at which were present:—Colonel Cowie, R.E., Manager; Mr. C. S. Rennick, Chief Engineer; Mr. T. Gregson, Locomotive Superintendent; and Mr. H. E. Rose, Signal Engineer.

The general scheme for training permanent-way inspectors was explained and was approved of generally. Mr. Rennick stated the difficulty experienced was not so much the technical education of apprentice permanent-way inspectors as in finding some suitable method of giving them practical training. The practical training given under permanent-way inspectors was not satisfactory. The men might be quite good at their work, but unable to teach others.

Mr. Gregson said that they had no technical classes for Indian workmen, and in referring to the Lucknow Industrial school, he stated that it had proved of no help whatever to them. He would be glad to take technically trained students for their apprenticeship.

Mr. Rose stated that he badly wanted men for signal engineers and for train lighting purposes, but the men of the industrial school did not appear to have the requisite training to be of any use to him.

Cawnpore Woollen Mills.

151. We had an interview with Sir Alexander McRobert, who stated he had had several apprentices from Roorkee and had found the sense of discipline they displayed was an excellent feature. If men would complete a really hard two years' apprenticeship in mills after their technical courses, obeying all rules and hours, he thought it would show they possessed grit and he would be glad to get hold of them. Above all, these men must aim at making themselves *indispensable* to their employers. There were not many positions in his mill for men of the "improver grade," but he would always be glad to give apprenticeships to train men as far as he could.

(Sir A. McRobert having left for England has not confirmed the above, which is published on our own responsibility.)

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[1] See page 70.

CHAPTER XIII—PUNJAB.

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Delhi Tramways and Electric Lighting Company.

152. We had an interview with Mr. J. G. Griffin, the Manager. He stated he had had a number of apprentices from the Roorkee Mechanical Apprentice Class. Most of these he had found were excellent in a way and had done well. The only point was that on the completion of their apprenticeship they at once wanted positions of responsibility and were not prepared to accept salaries of ₹30 a month.[1] They were still too young for positions of responsibility and could not control labour. There was a great demand for good artizans and they were very hard to get. He was always prepared to take apprentices in his works.

Ganesh Flour Mills, Delhi.

153. We had an interview with Mr. C. R. Goodwin, the Manager. He stated that their business was more or less a specialised industry and there was very little room for technically trained Indians unless they could be specially trained, except in the engine room. He wanted educated Indians in the mills, but the only posts available carried about ₹60 to ₹100 a month. Most Indians who sent their relatives to the mills, sent them with a view to drawing salaries and not to work, though he had had two brilliant exceptions in men who had been trained in the mill, worked hard and were now in responsible positions.

Delhi Cotton and General Mills.

154. We interviewed Mr. Sri Ram, the Secretary, and Mr. K. K. Apte, the Engineer.

Mr. Sri Ram considered Textile Classes should be started in the neighbourhood of mills, but recognised the difficulties in doing so in the United Provinces. The men required in the Textile industry were not, in his opinion, men recruited from the "gentry" but from the sons of mistries who would really work hard with their hands. The mills were prepared to take apprentices if they would work. It is noticeable that the Manager G. D. Asser and the Engineer K. K. Apte were both originally trained at the Bombay Technical Institute.

Note by the Manager of the Delhi Cloth and General Mills Company.

155. I have the honour to acknowledge receipt of your letter No. 236, dated *nil*, with notes taken by you at an interview which you had with Mr. Sri Ram and Mr. K. K. Apte. I read the above notes and I find that they could not make it very clear what they wanted to say.

They wanted to show that the persons recruited from the gentry be not given certificates unless they join in the mills at least for two years and practically do the work with their own hands because after coming out from the Technical Institute they, being the sons of rich men, do not like to work with their own hands.

The sons of mistries after passing the Matriculation if taken in the Technical Institute will turn out to be better qualified men than the former, as they will have no hesitation in doing the work with their own hands. The other remarks as stated are correct.

[1] See paragraph 143.

Krishna Mills, Delhi.

156. We interviewed the Superintendent, Mr. M. N. Mehta, and the Manager, Mr. T. E. Brookes.

They stated that the great difficulty with men trained at technical institutes was to get them to take off their coats and work. They had had one first-class man from Bombay, Moti Ram.

Mr. Mehta considered there was no opening for men of a high class university type of training except as consulting Engineers, and they could only possibly carry out such work after long and varied practical experience. The men required in the textile industry were men recruited from the lower classes and educated up to about the middle standard—men who were accustomed to hard work by tradition and had not been spoilt by too high education. The mill would take in apprentices when required.

Hanooman and Mahadeo Mills, Delhi.

157. The Manager being absent we interviewed the weaving master, Mr. A. P. Wadia. He was of opinion that unless men educated at technical institutes were willing to work on low salaries at practical work for some years to gain practice experience, they were useless. They had great trouble in Delhi in obtaining both skilled and unskilled labour, and would be quite prepared to take apprentices.

The P. W. D. Central Works, Amritsar.

158. Mr. John Ashford, the Superintendent, was interviewed and explained the character of work and type of men he demanded. He was strongly in favour of technical education on proper lines and would assist by taking apprentices.

Mr. Ashford thought that technical education should only be carried out by really practical men who had also commercial experience, and that whatever was spent in education of this character it would be justified if it produced only one "Watt" or "Stephenson."

He had had technically trained men at various times and was generally speaking satisfied with them; his present workshop foreman was educated at the Victoria Jubilee Technical Institute, Bombay, and was a good example of a man trained in India.

The engineer in charge of the electric power plant was a Roorkee student, and he was also satisfactory.

Some men that he had tried imagined that their technical college training had converted them into superior beings who should not be required to work but merely to look on and direct others to do the work. Such "black-coated" individuals were of little use, and all students in technical colleges should be led to understand that their use is to work with their hands until such times as they have practically proved themselves capable men.

The Amritsar Cotton and Spinning Co., Amritsar.

159. Mr. Devi Ditta Mall, the Engineer and Manager, was interviewed. He said he would be glad to employ technically trained Indian apprentices in the mill provided that his Directors did not raise any objection, and he felt sure they would not. He stated that he wanted better trained men in the mill and at present could not get them. As a practical man he felt sure that it would be a distinct benefit for students to have some practical experience before any certificate was granted; it would enable the authorities to weed out the men who would not work, and those that did work would gain much experience and be more useful.

The Directors agree to take technically trained Indian apprentices in the mill but as "unpaid apprentices." (This is the only case we have met where employers are unwilling to pay apprentices.)

The North Western Railway, Lahore.

160. At this interview the following gentlemen were present:—Sir H. P. Burt, K.C.I.E., General Manager; Mr. A. Rowland, Chief Engineer; Mr. I. H. Smiley, Carriage and Wagon Superintendent; Mr. R. K. Biernacki, Locomotive Superintendent; and Mr. L. M. Dickens, Electrical Engineer.

Mr. Biernacki said the North Western Railway had a technical school at Lahore for the European and Eurasian apprentices working in the Locomotive shops, but none for the Indian apprentices. One difficulty was that many of the lads attending the technical school had not received a sufficiently good general education to get the full benefit from their technical instruction. Steps were now being taken which it was hoped would tend to remedy this. He was a strong believer in the benefit of *sound* technical education and would like to see the Indian Apprentices get the benefit of it also. But the difficulty in regard to defective preliminary (general) education was even greater in the case of Indian than in the case of European lads. The only educated Indians they could get at present did notbelong to the artizan class, and as a rule only Indians of the artizan class made competent mechanics. Technical instruction given in conjunction with a complete practical training was of decided value; but technical instruction given by itself, or with a mere knowledge of the handling of tools, was useless. Employers paid men for what they can *do*, not for what they *know*. He was of opinion that industrial schools were useless for training mechanics—in fact he attributed the discrediting of technical education in many parts of the world entirely to the attempt to train men in schools and colleges where really practical work was not done. Three things were necessary to make superior mechanics (1) a good preliminary (general) education, (2) a sound special (technical) education, (3) a full practical training, and *they must all go together*. There was a wide demand for superior mechanics, and such men could obtain employment at good rates anywhere; but no one wanted the "technically trained" men who cannot do practical work. He would be glad to do anything he could to encourage sound technical education, and would accept young men from Technical Institutes, if they were men of the right stamp and would work, but they must serve their full apprenticeship in the workshops.

Mr. Rowland said that the North Western Railway recruited Permanent-way Inspectors from their own apprentices. The apprentices were generally the sons of old employés of the Railway and had to produce certificates of certain educational qualifications before being accepted. They entered into an agreement to serve four years apprenticeship during which time they were paid subsistence allowance. For the first two years they were trained in out-door Permanent-way work under a qualified Permanent-way Inspector. At the end of this time they had to pass an examination in the duties of a Permanent-way Inspector (theoretical and practical), organizing labour, Hindustani, Rules and Regulations, etc. During the third year they were trained in office work connected with the duties of a Permanent-way Inspector; during the fourth in interlocking, signal work, and points and crossings, and, if qualified, they were put in charge of a length of line under a Permanent-way Inspector. At the end of the fourth year, if qualified, they were appointed as Permanent-way Inspectors if vacancies existed. In many instances the Inspectors were incapable of instructing the apprentices properly and the result was not all that could be desired. He thought that theoretical training was most necessary, was of opinion that if the men were selected from the artizan class, they would give better results. Very few Indians were employed as Permanent-way Inspectors.

Mr. Dickens said that he had a few openings for "practical armature winders" only, and the wages paid to these men would be R2 per day. Regarding men for looking after telephones, bells, fans, motors, etc., his own trained men had proved the best.

The Signal Engineer was not present, but Mr. Rowland stated he knew the requirements of this department and that there was an opening for apprentices of the "improver" type, a certain number of whom had yearly been taken from the Mechanical Apprentice class at Roorkee.

Note.—We also had interviews with Harkishan Lal & Co. and Mela Ram & Co., but the reports of these interviews have not been confirmed up to date.

CHAPTER XIV.—TRAINING OF THE PERMANENT-WAY STAFF FOR INDIAN RAILWAYS.

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Note by Mr. E. F. Sanders, M.I.C.E., Chief Engineer, Bengal-Nagpur Railway.

1.—PERMANENT-WAY STAFF.

161. The present system under which apprentices for Permanent-way are trained on the Bengal-Nagpur Railway is as follows:—European or Eurasian lads between the ages of 16 and 20 who have passed an examination equivalent to the 6th Standard of the Government Educational Code are placed under the orders of a Permanent-way Inspector to learn the work in a practical way and receive such instruction from him as he is capable of giving. They are required to produce certificates of character and the children of respectable parents are selected. They receive a subsistence allowance of ₹20 per mensem for the first year, ₹30 for the second, and ₹40 for the third, and are not allowed free quarters. They are examined annually.

This system has proved most unsatisfactory for the following reasons:—

(*a*) The Permanent-way Inspectors under whom they are placed are not always of a class or character which marks them as desirable instructors of young boys, and they do not in all cases show much interest in training the lads under them.

(*b*) The boys are very insufficiently educated before being taken on and have no opportunities of improving their education during the course of training.

(*c*) The moral atmosphere in which a young boy finds himself living as best he may, without quarters, at out-of-the-way places, on an allowance insufficient to support him and without home discipline is in itself most undesirable. When to this is added the example of a bad class of Permanent-way Inspector, it cannot be wondered that some of the most promising boys turn out absolute wasters. This is partly the fault of the system and partly due to the parents, who expect their sons to maintain themselves respectably on an allowance which is really only intended to assist towards their support.

(*d*) The technical training is of the poorest description, as the men under whom the boys are placed are frequently incapable of instructing them in anything beyond the mere packing of the road.

It is very necessary to change the whole system and give our future generation of Permanent-way Inspectors a training which will make them thoroughly reliable and efficient men who will be a credit to the Railway on which they serve.

To attain this end it is desirable first to consider how to train the boy's character, and next what it is necessary for him to know.

With regard to the former it will, I think, be generally recognised that the ordinary boy requires home discipline and influence coupled with a strict separation from bad company until he has at least reached the age of 19 years, when he may for the first time be allowed to shift for himself, his character having been formed. These conditions can only be obtained by keeping the boys in a home or school where they are carefully looked after by respectable and competent persons. If therefore the Railway Company are to train up young boys efficiently they must provide a boarding-house, and a competent house-master at the place where they are to be trained.

The next question is what should their training be ?

A Permanent-way Inspector is required—

(*a*) To supervise and lay out the Permanent-way, including points and crossings, and he should be competent to use his intelligence in dealing with special and difficult problems connected therewith.

(*b*) He must be capable of constructing buildings, including bridges and culverts, and of devising and carrying out temporary means of restoring traffic in case of washaways and other accidents.

(*c*) He must be able to undertake the maintenance of signals and of pumps and sometimes of engines.

(*d*) To be efficient he should have been trained in the following subjects :—

(1) Blacksmith's, fitter's and carpenter's work.
(2) Building construction.
(3) Mensuration.
(4) Trigonometry sufficient for the laying out of curves.
(5) Drawing and taking dimensioned sketches.
(6) The use of surveying instruments.
(7) The keeping of accounts and preparation of returns.
(8) The theory and practice of permanent-way laying and maintenance.
(9) The general principles of mechanics and strength of materials.

These subjects cannot be taught on a Railway without a special staff.

Some Railway Administrations have made an effort to supply as much of this training as is possible without employing an educational staff.

The Oudh and Rohilkhand Railway make the boys work successively in the Workshops, the Drawing Office under the Inspector of Works, in the Executive Engineer's Office, and finally under a selected Permanent-way Inspector.

They have geographical advantages in that the works and offices named are at the same place.

These advantages do not obtain on the Bengal-Nagpur Railway, and in order to carry out such a scheme it would be necessary either for us to have several boarding-houses in different places or to let the boys shift for themselves when not actually at work with the probability that concurrently with their technical training they would receive the very worst moral training imaginable.

Such being the conditions, the question presents itself whether it is not a mistake for Railways to undertake this work at all, and whether it could not be done far better by the recognised Educational establishments having whole-time staffs whose speciality it is to train and control young lads.

Sibpur College is at our doors. It has already a most excellent curriculum for training Overseers for the Public Works Department, and the subjects taught are almost identical with what we require.

All that is necessary is that in the fifth year boys should be encouraged to specialise in the subjects immediately connected with the duties of a Permanent-way Inspector, that they should be given facilities by Railway Administrations to become acquainted practically with the method of carrying out important works, such as relaying, remodelling station yards, etc., and should be encouraged to learn their profession practically by working with their hands, putting together, and laying cross-overs and packing the road.

The danger of employing college-trained lads is that they may consider themselves above the manual details which it is so necessary for a Permanent-way Inspector to master himself before he can train his men.

No boy will be on the road to become a good Permanent-way Inspector until he has got over false ideas of this kind, and they must all be taught from the first that it is as necessary for them to master the manual portion of their profession as the theoretical part which will enable them to carry it out intelligently.

The prospects which are open to a well-trained Permanent-way Staff should attract the best men who will have opportunities of starting as Junior Assistant Inspectors on ₹80, and of rising to 1st grade Inspectors on ₹350. The Bengal-Nagpur Railway could employ at least three properly qualified lads annually on these terms and frequently the vacancies will be six or more.

If the lads so trained turn out well there will probably be a large demand for them on other railways.

II.—Signal Apprentices.

Having dealt very fully with the training of Permanent-way Apprentices it is not necessary to enter into such detail with regard to Signal Apprentices.

1. Their training should be that of the Mechanical Overseer class, special care being taken to instil into their minds the necessity of extreme accuracy. They should be accustomed to make, erect and adjust the component parts of both mechanical and electrical interlocking installations.

2. Their status will be parallel to that of the Permanent-way Staff, and the opening to qualified Signal Inspectors is very wide, because while nearly all Indian Railways are adopting interlocked signals, staff trained to erect and maintain them hardly exists in India.

III.—Block Instrument Mistries.

1. A third class of Railway employé that could be well and efficiently trained at Sibpur is the Block Instrument Mistri.

2. The College already has Mistri classes, and what is required for the above purpose is a thoroughly intelligent and careful Electrical mistri who has special knowledge of the Electrical Block Instruments in general use in India.

3. With the general introduction of Electrical Block Instruments throughout India the openings for this class of men are extremely good.

4. The range of pay will probably be from about ₹50 to ₹130.

Note by Mr. H. Jellet, Chief Engineer, Bengal-Nagpur Railway.

162. I send you herewith a copy of the note in question (Mr. Sanders'). I quite agree with 6 (*d*), but would add a 10th item, namely, "the principles of Signalling including Interlocking."

The paragraph II, Signal Apprentices, does not quite apply now. We now make our Permanent-way Inspectors responsible for the maintenance of all the Signalling on their section, so it is necessary that they should be familiar with the principles of Signalling to start with, and subsequently with the details of the construction of the Signalling in their charge.

I also send you a note drawn up at my request, and with which I agree, by Mr. Taylor, our Deputy Chief Engineer, and one by our District Engineer, Signals. I have approved of the latter also. You will see that the list of subjects in Mr. Taylor's note is that appearing in Mr. Sanders' note, paragraph 6 (*d*), with the addition of the item *re* Signalling.

Note by Mr. W. V. Taylor, Deputy Chief Engineer, Bengal-Nagpur Railway.

163. The following is a list of the number of Permanent-way Staff employed on this line:—

	Number sanctioned.	Number employed at present.	Pay.
			₹
Permanent-way Inspectors, 1st grade . . .	7	5	300—350
Ditto 2nd „ . . .	7	4	225—300
Ditto 3rd „ . . .	...	15	180—250
Ditto 4th „ . . .	...	28	100—175
Sub-Permanent-way Inspectors	...	54	40—100
Apprentice Permanent-way Inspectors, 1st year .	24	13	20
Ditto 2nd „ .	...	...	30
Ditto 3rd „ .	...	...	40

Note.—The number of Indian apprentices is limited to 6 at one time, the rest being either European or Eurasian.

In one or two exceptional cases, such as boys taken from St. Andrew's Homes, who have no parents to assist them, apprentices have been granted ₹40 per month to commence with.

The present practice on this railway in appointing apprentices who work and are trained under the Permanent-way Inspectors, is to give preference to sons of employés of good character who are working in the railway.

They must be between 17 and 20 years of age, have passed the 6th Standard, have a good school character and produce a medical certificate of sound physique. This practice has not turned out to be a good one, as although in some cases they do pick up a good practical experience of Permanent-way work from the Permanent-way Inspectors they are placed under, in very few instances have they any opportunity of acquiring the theoretical knowledge they should have to eventually rise to the top grades in the Permanent-way Staff.

Being scattered all over the line under various Permanent-way Inspectors they have no opportunity of attending night Technical Schools as the Locomotive Department apprentices have.

We should eventually have a much better Permanent-way Staff if we could obtain suitable young men who have had a certain amount of theoretical and practical training in a Government Technical College.

I would suggest, that if they could be obtained after they have been through a course of say three years, and passed the Sub-Overseer's, or better still the Overseer's examinations, and in addition pass through a special Permanent-way class, and so obtain the theoretical knowledge that the Permanent-way Staff should have, they would then have a sufficient knowledge with say one year's practical training under a good Permanent-way Inspector, and a short course of instruction under a Signal Inspector to make a far better qualified Sub-Permanent-way Inspector than those we now obtain through our own apprentices. Men trained in this way would rise much quicker to the higher grades of Permanent-way Inspector than the present men we employ have done. The following are the subjects which, I suggest, should be taught in the special Permanent-way class:—

(1) Blacksmith's, fitter's and carpenter's work.
(2) Building construction.
(3) Mensuration.
(4) Trigonometry sufficient for the laying out of curves.
(5) Drawing and taking dimensioned sketches.
(6) The use of surveying instruments.
(7) The keeping of accounts and preparation of returns.
(8) Theory and practice of permanent-way laying and maintenance.
(9) The general principles of mechanics and strength of materials.
(10) The principles of signalling including interlocking.

For the year of practical training under our own Permanent-way Inspectors they could be given a pay of R40, and if found suitable after that period, as vacancies occur, be appointed as Sub-Permanent-way Inspectors starting at say R50 per month, although more might be given to exceptionally good men.

The following are the number of men newly engaged for Permanent-way Staff during the past seven years :—

Year.	Apprentices.	Sub-P.-W. I.	P.-W. I.	Year.	Apprentices.	Sub-P.-W. I.	P.-W. I.
1905 .	3	3	...	1909 .	10	3	...
1906 .	4	1	1	1910 .	4	...	1
1907 .	3	6	3	1911 .	4	2	2
1908 .	1	5	2				

Note by Mr. W. A. Cosserat, District Engineer, Signals, Bengal-Nagpur Railway.

164. There are at present about 70 skilled Indian workmen employed on this railway to look after the maintenance of signals and interlocking, and this number will have to be increased very shortly.

In addition to the number of men employed as above, who are chargeable to revenue, we employ about 50 fitters, blacksmiths and carpenters for the erection of new interlocking installations.

The following are the grades and rates of pay now in force :—

(1) Fitters, blacksmiths and carpenters . . .	R 20 to 50
(2) Erectors	R 60 to 100
(3) Sub-signal Inspectors	R 100 to 200
(4) Signal Inspectors	R 200 to 400

As electrical appliances are now being largely used in connection with interlocking installations there is an increasing demand for electrical fitters and inspectors. At present we employ one inspector and four fitters for the maintenance of electrical appliances.

The class of men who are at present employed as fitters and erectors are not educated and consequently cannot be promoted to the Inspector grades. It would therefore be a distinct advantage if say 5 per cent. of the men in grades (1) and (2) were technically trained. We would then be able to fill up the vacancies in the Inspectors' grades by men who had received practical training on our railway.

We could find vacancies now for two Technical apprentices on the Revenue establishment and four for capital works now in progress. They could be taken on trial say for one year, and if satisfactory reports were received they would be retained for three years, and at the end of this period, if there were any vacancies, they could be promoted to the grade of erectors. All subsequent promotions would of course be then dependent on the abilities shown by them and the chance of vacancies occurring.

Note by Mr. F. J. Preston, Chief Engineer, 1912, Great Indian Peninsula Railway Company.

165. I agree entirely with the remarks made by Mr. Sanders in paragraphs 2 to 6 inclusive, and paragraph 10 of his note.

2. I am of opinion that there is no need to take on apprentices from outside. We should select from the sons of our own employés who have the best claims on us, boys of 16 to 17, of good character and physique, who have been educated up to the 7th or 8th Standard, and we should send a certain number to the technical schools for two years' training, giving them a subsistence allowance of say R30 to R40 a month whilst there.

If the boys are badly reported on, after the first year, they should be got rid of and the vacancy filled up.

3. After their technical school training, they should be placed for six months in the District Engineers' Drawing Offices, and then placed under selected Permanent-way Inspectors for 1½ years. During the two years following the technical school training they might be given ₹50 the first year, ₹60 the second year.

4. At the end of two years they would be required to pass an examination, and if successful, would rank as sub-inspectors commencing on ₹90.

5. We should, no doubt, contribute towards the education of a certain number of failures, but the men we got would certainly be much better trained than any of our present Permanent-way Inspectors.

6. You will understand that I am expressing my own views only, and it does not follow that they are the views of my Board.

Note by Mr. W. H. Wolff, Chief Engineer, Bombay, Baroda and Central India Railway.

166. The Bombay, Baroda and Central India Railway (broad gauge) has no system of training apprentices, the Rajputana-Malwa Railway has, and when acting as Engineer-in-Chief there, I found the results to be very discouraging. On this system, I recruit, since a year, our Sub-Inspectors entirely from the Sub-Overseer class of men. There is not time enough yet to judge of the result, but owing to insufficient theoretical and practical previous training in railway matters I do not anticipate satisfactory results. The pay does not attract men from the Overseer class.

I have placed it on record when I was last year President of the Institution of Permanent way Inspectors that I consider the money now spent by Railways on apprentice classes of their own would far better be employed in contributing towards the training of bright, and morally and physically-fit sons of their own servants in our best Technical Colleges (Roorkee, Sibpur and Poona), by the creation of a special chair on railway subjects, the theoretical and thorough practical training going hand in hand. I find it, for instance, now impossible to get an Inspector to get a turn-out ready with closers placed near site of an old one of a different rail section, to replace the latter within a few hours, when heavy traffic requires such a procedure. The boys should be taught to build a spiked sleeper crib, to handle girders and adjust curves, giving them transition curves, etc. The professors should therefore be theoretically and practically Railway specialists. It is only then we shall get the proper class of men. The first pay on engagement would probably have to be raised from ₹40 to ₹60 or ₹70, but such men would be worth the money. I need hardly add that their formation of character is of the greatest importance. The moral atmosphere should be a pure and high one, and the boys should be made to work with their own hands, clean their boots themselves, and be brought up to look upon the dignity of manual labour as the most valuable asset in a man's conception of life.

East Indian Railway.

167. This railway was satisfied with their present arrangements for the training of the Permanent-way staff.

Mr. H. B. Taylor, Chief Engineer, Eastern Bengal State Railway.

168. They had great difficulty in obtaining a proper class of men as Permanent-way inspectors, and would be glad to join a scheme for training such as that suggested by Mr. Jellett, Chief Engineer, Bengal-Nagpur Railway. They quite agreed with the views expressed by him as to the disadvantages of the present methods of recruitment, and also with the proposals set forth for training courses, and approved of the idea that they, in common with other Railway Companies, should be allowed to nominate students who were sons of the present employés, always provided that the education they possessed was of the required standard.

Extract from interview with Mr. E. A. Neville, Manager, and Mr. W. S. Turnbull, Chief Engineer, Bengal and North-Western Railway Company.

169. With regard to permanent-way inspectors it was admitted that their present method of training was not all that could be desired, and the scheme of education as proposed by Mr. Jellet they thought was suitable, but they also thought it doubtful if they sent apprentices to be trained on these lines that it would pay them, as such apprentices would probably on the completion of their course of training, leave them to join any other railways who might offer higher wages.

Mr. C. S. Rennick, Chief Engineer, Oudh and Rohilkhand Railway.

170. Mr. Rennick stated the difficulty experienced was not so much the technical education of apprentice Permanent-way inspectors as in finding some suitable method of giving them practical training. The practical training given under Permanent-way inspectors was not satisfactory. The men might be quite good at their work but unable to teach others.

Note by Mr. G. W. Moore, Acting Chief Engineer, South Indian Railway Company, Limited.

171. As Mr. Lewis is on leave and I am acting for him, I venture to reply to your letter of 28th ultimo.

On this railway, we always have a certain number of young men, designated Probationary Sub-Inspectors, under training. When there is a Probationary Sub-Inspector's vacancy, a selection of those applicants who are most likely to suit is made, sons of old employés of the Company being given preference, and a qualifying and more or less competitive examination is held by a senior officer. The lad who, in the judgment of the officer, has the best all-round qualifications is selected to fill the vacancy, and forthwith commences his training as a Probationary Sub-Inspector.

The training extends over three years, during which time the lad receives training in the Drawing Office, Surveying, the Workshops and Permanent-way. For the training in Permanent-way he is put under one of our covenanted Platelaying Inspectors, and afterwards, to finish off, very often under a Section Permanent-way Inspector. During training the Probationary Sub-Inspectors receive a subsistence allowance of from R20 to R30 per month.

I do not look upon a technical education as absolutely essential, though of course, in making the selection of candidates for the examination, it is greatly in a lad's favour if he has had some technical education. The difficulty lies in obtaining lads who are sufficiently well educated and intelligent enough to eventually become Permanent-way Inspectors. This is the experience in the case more particularly of European and Eurasian lads, which is unfortunate, because they make as a rule the best Inspectors.

Practical knowledge is after all what a Permanent-way Inspector requires, and my experience is that college trained lads are apt to consider manual details beneath them. I entirely agree with what Mr. Sanders, the Chief Engineer, Bengal-Nagpur Railway, says in paragraph 10 of his note on the subject under reference in respect to this.

I consider that the training the lads get under the system on this railway is a sufficient and good one, but what we want are better educated lads who have a certain amount of technical training to enable them to make good use of their time during training, and to fit them thereafter for a Permanent-way Inspector's duties.

Mr. A. B. Strange, Chief Engineer, Madras and Southern Mahratta Railway, Madras.

172. With reference to training of Permanent-way inspectors, Mr. Strange stated that he had not been satisfied with men of the overseer class whom he had tried, but would be glad to take one or two of this class provided that the College of Engineering, Madras, would give them a special training.

At present they selected their men by holding examination and had no difficulty in meeting the demand for Permanent-way Inspectors. The scheme proposed for training Permanent-way Inspectors was outlined, and Mr. Strange expressed his approval of the idea, and liked the idea of being able to nominate his own men, and probably would be able to arrange for some support being given to the nominated students while undergoing their technical course.

Note by Mr. A. Hudleston, Chief Engineer, Madras and Southern Mahratta Railway Company, Dharwar.

173. I beg to acknowledge your letter of 28th March 1912, with enclosures on the subject of training of lads for posts of Permanent-way Inspectors.

On the metre gauge portion of Madras and Southern Mahratta Railway we have provision for probationers on an accumulated subsistence allowance of R120 for the 4 lads.

We mostly encourage promising children of our old employés to such position.

They have at first to undergo a preliminary examination as to general fitness and are generally about 18 to 22 years old.

The lads are as a rule educated up to 6th Standard, and many have seen a little Permanent-way work with their fathers.

They are taken into my drawing office for training in land plans and other draftsmen's work, after which they are sent out to work under some Permanent-way Inspector.

When considered ready for examination they are examined in Mensuration, Drawing, Estimating, Rules and Regulations, Permanent-way and *vivâ voce* as to general intelligence.

If they pass the examination they become eligible for the post of Sub-Inspector, otherwise they are sent back for a further period, generally about six months, and again examined.

Failures if suitable for work as Timekeepers, etc., are engaged in such positions and allowed once more to appear for examination, but not after 27 years of age.

I quite agree with what Mr. Sanders says in the tenth paragraph of his note of 6th January 1909, as this defect is manifest in almost all the lads we accept as probationers.

What a Permanent-way Inspector requires for his work is interest in his employment, the practical and methodical application of his knowledge of Permanent-way and works both in building and iron work, the intelligent use of professional pocket books so far as they apply to his duties, eyes and mind trained to see defects in detail of all sorts and understand them and recognize quickly what is needed and willingness to carry out the needful without delay and assist in the manual work personally if desirable without false ideas about his superiority.

Most of this a lad cannot acquire at college, it has to be drilled into him out of doors in actual responsible work ; so in my opinion college training should not be carried very much further than sound elementary grounding and the awakening of the brain.

I therefore consider that if each railway had a practical school with a whole-time master for technical training, better results would accrue in one year than by two years at college.

I do not consider that the Directors of any commercial undertaking such as a railway would consent to subscribe for 3 or 5 years' training of lads at any college with the off chance of finding employment for them afterwards.

Note by Mr. A. Rowland, Chief Engineer, North Western Railway.

174. Mr. Rowland said that the North-Western Railway recruited Permanent-way Inspectors from their own apprentices. The apprentices were generally the sons of old employés of the Railway and had to produce certificates of certain educational qualifications before being accepted. They entered into an agreement to serve four years as apprentices, during which time they were

paid subsistence allowance. For the first two years they were trained in outdoor Permanent-way work under a qualified Permanent-way Inspector. At the end of this time they had to pass an examination in the duties of a Permanent-way Inspector (theoretical and practical), organizing labour, Hindustani, Rules and Regulations, etc. During the third year they were trained in office work connected with the duties of a Permanent-way Inspector; during the fourth in interlocking signal work, and points and crossings, and if qualified, they were put in charge of a length of line under a Permanent-way Inspector. At the end of the fourth year, if qualified, they were appointed as Permanent-way Inspectors if vacancies existed.

In many instances the Inspectors were incapable of instructing the apprentices properly and the result was not all that could be desired.

Mr. Rowland thought that the theoretical training was most necessary and was of opinion that if the men were selected from the artizan class, they would give better results. Very few Indians were employed as Permanent-way Inspectors.

Copy of a letter No. E. 144 M., dated 6th March 1912, from the Manager, North Western Railway, Lahore, to the Vice-President and Treasurer, Permanent-way Institution of India.

175. In continuation of this office letter No. E.—258 F., dated 8th July 1911, I beg to state that I think the Apprentice Permanent-way Inspectors and Apprentice Signal Inspectors could be much more cheaply and efficiently trained to suit our requirements than is the case at present, by arrangement with some Engineering Colleges or other educational Establishment.

At present we take from any school boys, aged about 17 years, who are generally sons of old employés of the Railway. Those boys have no theoretical training of any kind to fit them for engineering work, but it is necessary that they should have passed an examination equivalent to Standard VI of the Government Educational Code. They are put under a Permanent-way Inspector, who may or may not be a capable Instructor however efficient he may be as an Inspector. They have to serve four years as Apprentices, during which time they receive subsistence allowance amounting in all to R2,820 in the case of European and Eurasian Apprentice Permanent-way Inspectors, R1,260 in the case of Native Apprentice Permanent-way Inspectors, R3,420 in the case of European and Eurasian Apprentice Signal Inspectors, and R1,620 in the case of Native Apprentice Signal Inspectors. It is true that we get some return for this outlay in the work done by the Apprentices, but the return is small for the expenditure incurred.

I agree with Mr. Wolff that the syllabus of the course of study for Lower Subordinates at the Roorkee College which I understand is a two years' course and comprises 13 subjects, seems to meet the requirements of apprentices. It might be possible to make some arrangement with the Roorkee College whereby our apprentices could be trained in this class and to guarantee a certain number of appointments each year. We could then select promising youths from amongst the sons of deserving employés, to be sent to the college, for whom we would contribute to the college and appoint a certain number of those who qualify as apprentices to undergo a further two years' training under experienced Inspectors, the parents or guardians of the youths towards whose training a contribution has been made by the Railway guaranteeing that their sons or wards would serve the Railway for a period of years, or that the contribution would be returned, although I am not clear as to how this can be enforced. It would seem that by this means we would for a less expenditure than is incurred at present procure a better trained class of apprentices, who would be more satisfactory and who would at the same time save the Railway the labour and part of the expense incurred in giving him the foundation of his training. I am, however, doubtful as to whether it would be possible to restrict the class opened at the college to sons of Railway employés, and the basis on which the Railway should contribute to the College and other such questions would have to be considered later on if the other Railways fall in with these views.

PART III.

Special Recommendations on Subjects closely connected with the Object of the Enquiries.

CHAPTER XV.

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CHAPTER XV.

I.—State Technical Scholarships in Europe.

State Technical Scholarships.

176. The prevailing opinion of employers seems to be unfavourable to the present system under which Indians are sent to Europe for technical training, and as far as our enquiry has enabled us to determine we are in agreement with this opinion.[1]

At present a student is usually sent for a three years' training in some recognised institution and has no time, even if opportunity offered, to do any practical work whatever, outside that which his educational course demands, and consequently he usually returns to India lacking in the most important part of his training. Educational distinctions achieved in England or elsewhere are, from the commercial point of view, useless to any employer unless practical experience has been obtained in addition. In England, Germany and America, employers are usually not prepared to allow casual students to potter about their mills, workshops or factories while they are undergoing their course at an institute, interfering with their workmen and by their irregular attendance and disregard of workshop hours, setting a bad example to the rest of their employés. We are of opinion, however, that employers would be willing to take trained students for a three years' practical apprenticeship, during which their services would be of some value.

Recommendations.

177. We recommend that students should not be sent to Europe till they have learnt all that they can possibly learn in this country, both practically and theoretically, of the profession they have chosen, wherever the facilities may exist. That they should then be apprenticed with some firm of repute in Europe with whom they would have to put in the three years under actual working conditions, and learn details of practical work and the organization of a modern manufactory, and by actually working under commercial conditions learn to direct others with some degree of authority.

If this suggestion meets with approval we would point out that the amount of the present State Technical Scholarships might with advantage be reduced to such a sum, that the student would be compelled to become a wage-earning factor and assist in supporting himself. We feel convinced that such a scheme if adopted would result in producing a more useful class of men than under the present system and men who on their return would find ready and remunerative employment and in the end tend to open up the industrial prosperity of the country.

II.—Suggestions for the Control of Minor Institutes and the Standardizing of Certificates.

178. It is generally admitted that the present system of many independent institutes, each with its own idea of instruction in technical subjects, is neither satisfactory, economical nor successful. Under the existing system each institute is entirely free to adopt whatever scheme of instruction it thinks fit, to appoint whatever instructors it may consider qualified, to adopt its own methods of instruction, to conduct its own examinations under what standard it may deem sufficient and to grant certificates under its own name.

The standard of admission varies from the 2nd Anglo-Vernacular to the Matriculation. The curriculum and methods of instruction, the standard and conduct of the examinations are dissimilar, and consequently the certificates have no corresponding value. There is no classification, *i.e.*, no differentiation between schools and institutes of entirely different character.

Unfortunately the public does not recognise any difference in the value of certificates granted, and the employers of students are often disappointed in not securing the standard which they have been led to expect; the result of all this is that technical education has been, and will be, subjected to a large amount of justifiable criticism, and employers of labour prejudiced against the outturn until some steps are taken to put technical education under proper control.[2]

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[1] See paragraphs 50, 51, 62, 80, 84, 85, 94, 100, 117, 139, 144.
[2] See paragraph 45.

If this view is accepted it must be admitted that no great or general good can be expected from small isolated institutes which at present have not got the benefit which the control and guidance of a central institution would give them.

Central Institute.

179. We, therefore, consider that in certain Provinces where the need exists, there should be established a central Institution which, as the embodiment of the highest standard of instruction of a technical character needed, can not only direct and control the teachings of these schools, but supply them with new ideas and furnish them with a suitable model on which their scheme of education may be carried out with success.

Subordination of smaller Institutes.

180. With regard to such a scheme we consider it necessary that the smaller institutes must be subordinated to this central authority so that the preliminary training which is necessary in all branches of technical education may be brought up to a proper standard and that the students of these smaller schools may on finishing their course in them be in a better position to become useful members of their trade than at present, or if they desire to proceed to a higher training, may be able advantageously to take up the more advanced courses of the central Institution, and may enable that Institution to dispense with the preliminary courses which occupy so much time that might be more usefully employed in other branches of the various subjects.

The position of the proposed central Institute is analogous to that accorded to the University in respect to the Arts and Science Colleges; the courses of instruction are regulated by the University which is responsible for their inspection, and tests the instruction given by holding examinations, and granting degrees or diplomas. This system is now more or less carried out as far as civil engineering in Bengal is concerned by the joint Technical Examination Board.

Obligations of the central Institution.

181. We consider the central Institution should be responsible—

(1) For the suitability and efficiency of the courses of instruction and the staff of instructors.

(2) For seeing that suitable plant, equipment and tools are maintained.

(3) For improvements in work and instruction.

(4) For the periodical inspection and examination of the various schools and granting certificates of various grades.

(5) Generally for the technical education of the presidency.

Scheme of inspection and examination.

182. Under the scheme proposed the staff of the central Institute, strengthened where necessary, and assisted by such other competent inspectors as may be found, should conduct periodical inspections of the smaller schools twice a year and make occasional visits.

The annual examinations should be conducted simultaneously at different centres by a board of examiners appointed by the central Institute and certificates granted under its seal.

Grants-in-aid.

183. Grants-in-aid should be paid by Government on the recommendation of the central Institution based on the reports of inspection and examination.

Concessions in length of course at central Institution for students from minor Institutes.

184. It is proposed that students of Institutes subordinated to the central Institution, should, if they have passed the required standard, be given concessions of one or more years in the higher courses of the central Institution, and it is confidently expected that the subordinated Institutes will in the long run provide a considerable number of students for the central Institution who will have been already trained up to a point far in advance of that possessed by the students at present offering themselves for admission.

Increased efficiency of the central Institution and opportunities for obtaining technical education being open to all inhabitants of a province.

185. The above suggestion will, in our opinion, result in a greatly improved standard of work in the central Institution and will be the means of carrying on education to a point equal to that of the recognised technical schools in England.

A further advantage will be that the facility for obtaining a higher technical training will be within the grasp of the inhabitants of the various districts of a province, who generally at present do not know how to set about obtaining such an education.

III.—The Training of Mechanics.

186. The question of training skilled mechanics has so repeatedly been brought into prominence during the interviews we have had with employers of labour and is so closely allied to the general scope of our enquiry that we have considered it in this chapter. The classes of men included under the term skilled mechanics.

For this purpose the term mechanic includes fitters, turners, moulders, carpenters, blacksmiths, patternmakers, jobbers, mistris, in fact the great army of the rank and file of the professions under discussion.

187. On page 26 of Sir Edward Buck's Report on Practical and Technical Education it is stated on the authority of Mr. Chatterton "the number of artizans in India is undoubtedly in excess of the normal requirements of the country." At the present time it is certain that the number of *skilled* artizans falls far short of the requirements of the country. The demand for skilled labour.

Wherever we went, there was a universal cry for a better class of mechanics and the report of a scarcity of skilled labour.[1] In Cawnpore,[2] one employer of labour gave it as his opinion "that the reason skilled labour was inferior nowadays was that, years ago when the mills were being started, every European had to work with his hands and trained his men in the workshop. Nowadays, the mills being established, few Europeans found it necessary to work with their hands, and the workmen had not the same example and instruction before them."

188. The question of training an improved class of skilled labour is undoubtedly a thorny one. On page 22 of Sir Edward Buck's Report on Practical Education it is stated: "Persistent enquiries made in all the large railway workshops and private foundries and factories that time permitted me to visit proved the existence of an almost universal opinion that artizans' sons required no literary training." The education required.

From our enquiries we found this opinion has been modified, and the general opinion seems to be that the skilled workmen require vernacular education[3] in reading, writing, arithmetic, sufficient for elementary accounts, and sufficient knowledge of drawing to understand a dimensioned sketch. The great danger was, however, stated to be that such education might be carried too far. If this is done, the budding artisan gets "the head in air," probably deserts his trade, and tries to enter some less exacting line of life.

189. There seem to be only two methods of training:— Methods of training.

(*a*) Industrial Schools.

(*b*) Apprenticeship in works with literary education carried on concurrently.

190. The so-called Industrial Schools in this country have been scheduled in page 18 of Sir Edward Buck's Report on Practical and Technical Education, and the descriptions given more or less hold good to-day. Industrial Schools.

It will be observed that Sir Edward's suggestions for Industrial Schools given in Chapter III of his report, however sound they seem in theory, have not proved at all successful in practice in the eleven years that have elapsed since his report was printed.

Industrial schools as they exist in India have no parallel in any other country and seem to be indigenous to India. They certainly are not analogous to the English trade schools. Excepting so far as missionary efforts for orphans are concerned, they have been condemned in principle and practice again and again, and the general opinion expressed during our enquiry is that they are useless for turning out the required class of skilled artizans in the professions under discussion. This condemnation does not necessarily refer to the "Local Trade or Crafts School" recommended in resolution 119 of the Simla Conference of 1901.

The system of Industrial Schools was also condemned by the Committee on Industrial Education which sat in 1903 in resolution No. 16, which is one of the few resolutions of this Committee with which we agree.

[1] See paragraphs 100, 111, 118, 120, 121, 130, 131, 137, 139, 142, 143, 149, 152, 157, 160.

[2] See paragraph 143.

[3] Each province must consider its own special circumstances. In Madras, the education would probably be conducted in English.

We are of the opinion that industrial schools seldom can recruit from the right classes, they are generally inefficient and costly, the training is far too superficial, the pupil is not brought into contact with the trade he is learning, he lacks training in economy of production, and above all the hours of labour to which he has been accustomed unfit him for the long workshop hours to which he will have to conform in after life. Allowing, for argument, that an Industrial School can turn a boy out as a first class turner, this boy will have been for 7 years at the school where he has probably done 4 hours manual labour a day, Is it suprising if he turns out an unsatisfactory and inefficient workman when he has to work 12 hours a day in a workshop under commercial conditions ? At the school he has taken his time over each job ; in the workshop each lathe and machine has its money value in over-head charges and a manager cannot allow a job to take eight hours when it should take six if he is to run his shops as a commercial success. In certain cases industrial schools have been located in the vicinity of big railway shops with an idea of training the sons of the artizans in those shops. In answer to our enquiries the railway authorities state that they have not obtained any benefit from the schools and have no use for them except as night schools which workmen will sometimes attend to learn the " 3 R's" not for technical training.[1]

The apprenticeship system.

191. The chief advantages of this system are that the apprentices will be related by caste and heredity to the craft they work at and are not sons of peons or postmen who go to an industrial school to obtain a stipend or a cheap education ; the apprentice works from the start, under workshop and commercial conditions and workshop hours. The difficulties of turning out a more highly skilled mechanic by this system are that the teaching may be faulty unless some one in authority takes an interest in the apprentices ; the children of the artizan class are generally very uneducated and no special facilities have been made for their education, and in general workshops do not care to train apprentices for the public good, but expect them to remain as workmen while there are many outside openings clamouring for skilled labour.

192. The question is how can this small amount of necessary education be imparted. Night schools are out of the question, because, in the Indian climate after a hard day's labour, the Indian workman, and much more his child, is physically unfit to do any mental work however slight.[2] In Madras, as will be detailed later, the want of highly skilled artizans with some education is acute and the following experiment is about to be tried. In Madras the main private workshops, railway workshops and mills are more or less in one quarter. It is proposed to institute 200 State apprenticeships for the sons of artizans in these shops. An inspecting officer is to be appointed to see the apprentices are being fairly taught, and a school is to be erected in the centre which the apprentices will be bound to attend for a certain number of hours in the week.[3]

This promises to be a solution of this difficult problem and will be an interesting experiment to watch.

There is a school in Lahore called the Railway Technical School, which name is a complete misnomer. " The object of the school is to provide a suitable education for children of artizans employed in railway workshops. By a suitable education is meant an education in which instruction in reading, writing, arithmetic, elementary mechanics, physics and drawing is given in strict subordination to manual training in the workshops." The school is very popular with the class for which it is established, but probably errs in going a little too far in literary education.

Recommendations.

193. In our opinion[4] manual training schools on these lines could be successfully established in all big centres and near large workshops, care being taken to restrict the literary education to the minimum specified above and the boys drafted into apprenticeships in the workshops between the ages of 12 and 14. During this apprenticeship they should be obliged to attend afternoon classes for two or three hours a week to complete their elementary

[1] See paragraphs 139, 150, 160.
[2] See paragraphs 36, 110, 116, 119, 149.
[3] See paragraph 130.
[4] See paragraphs 139, 144.

literary education and towards the end of their five years' apprenticeship practical demonstrations and lectures might be given on the theoretical side of the various crafts.[1] For instance, the fitter might be taught how to line out work from machinery drawings, to lay out foundations for machinery of a simple character, to learn something of the management and working of an oil or gas engine.

The turner could be taught the various operations of work which it is possible to do on a lathe, the advantages of grinding his tools to a certain angle for various metals, and be given some idea of the cutting speeds necessary.

The moulder might be taught the value of various mixtures of iron for different castings and the method of obtaining these mixtures.

This education should be carried on in the manual training school with little apparatus or plant and preferably by experts from the workshops.

The question whether employers of labour will co-operate.

194. It will be argued that no workshop will permit its apprentices to absent themselves for these afternoon attendances; but they are going to permit it and encourage it in Madras, so why not elsewhere?

In Germany we understand apprentices in workshops are made by law to attend for literary instruction in schools. The Governments in India may not wish to adopt such an autocratic method, but there is little doubt they could bring pressure to bear if desired. In most cases, however, the managers of workshops are quite broadminded enough to see the ultimate good which will accrue to them and to welcome the proposal.

IV.—Boiler Act Certificates.

Value of certificates of competency.

195. A certificate of competency under one of the provincial Boiler Acts may be considered as an essential part of an engineer's training; for without this certificate charge of an engine and boiler is not allowed. We have found a ood deal of dissatisfaction existing with regard to the way in which these certificates are granted. And it would appear necessary to exercise greater care in the scrutiny of certificates submitted and only to recognise those from establishments registered as affording proper training.

We also found a good deal of dissatisfaction existing with regard to the manner in which examinations are conducted, and we suggest that better results would be obtained by the appointment of an independent examiner for each province in which the Act is in force.[2]

V.—Special Recommendations.

196. (1) That the present system under which State technical scholarships are granted to Indians for education in technical institutions in England and elsewhere should be discontinued. That suitable stipends should be granted to Indians, who have successfully completed their theoretical and practical education in India to enable them to be apprenticed for practical experience with firms of repute in England.

(2) That minor technical institutes should be placed under the control of one central Institution in each province in which such an Institution exists, with reference to its courses, equipment, examinations and certificates.

(3) That the education of skilled workmen should only be carried up to vernacular reading,[3] writing, sufficient elementary arithmetic for accounts and sufficient knowledge of drawing to understand a dimensioned sketch.

(4) That the most promising method of training skilled workmen is to establish manual training schools for children in big centres and near big workshops; the boys to be apprenticed in workshops from the ages of 12 to 14 years; during the apprenticeship they are to be obliged to attend afternoon classes to complete their literary education and finally to obtain some theoretical knowledge of their work.

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[1] This suggestion has also been made for the textile industry, see paragraphs 98, 99, 101, 102, 108, 110, 116, 117, 118, 121, 123, 125, 139, 145.

[2] See paragraphs 96, 124, 141.

[3] See note to paragraph 188.

PART IV.

Suggestions for adjusting the facilities for Technical Education existing in the various Provinces of India to meet the demands of Employers.

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CHAPTER XVI.—BENGAL.

197. The opinions expressed by employers of labour, on which our remarks are based will be found in Chapter VIII, page 19. Besides these we had conversations with the Chief Engineer and the Committee now sitting to formulate recommendations for the establishment of an Institute to replace Sibpur College. Opinions on which our remarks are based.

198. The professions and industries already developed in this province to such an extent that they can offer employment to technically trained Indians, which come within the scope of our enquiry are— Provincial Industrial development and the demand for technically trained Indians.

1. Civil Engineering.
2. Mechanical Engineering.
3. Electrical Engineering.
4. Coal Mining.
5. The Jute Industry.
6. Cotton Mills.

199. The prevailing opinion of employers of labour seems to be that the genius of the inhabitants of Bengal is not generally adapted for successful employment in the technical professions. A resumé of the opinion and experience of employers is as follows. They make excellent workmen, but the educated classes, even after training in a technical institute, are averse to manual labour as a regular employment. The material available.

We find, however, there have been some notable exceptions when the Bengali has been freed from his social influences and has mixed with men of other races. There is, therefore, even reason to assume that in future he will with proper training take his place in the technical professions.

200. Up to 1912 the civil engineering educational system of Bengal and Eastern Bengal and Assam were closely allied. Sibpur College was the largest of the major institutions teaching up to the civil engineer class standard, the Bihar and Dacca schools of engineering were affiliated to the overseer standard, while six minor institutions in Bengal and five in Eastern Bengal and Assam were affiliated up to the sub-overseer standard. The examinations for these two last standards are carried out by a Joint Technical Examination Board. Sibpur College is now, however, sold, and the province has been re-arranged, while a Committee is sitting to furnish recommendations for the future. Civil Engineering.

201. From the interviews we have had with the controlling authorities of engineering works we find that there is, and has been, a great demand for technically educated Indians, in every instance it was stated they were greatly in demand, and we were promised the most cordial support and assistance in any scheme which would provide a suitable class of man. It will be seen from the interviews which are recorded in Part II, that a man with the requisite training will have no difficulty in obtaining lucrative employment. The opinion was frequently expressed that if the educated Bengali was prepared to work practically he would be freely employed and given every opportunity for advancement, but he must understand that he must be prepared to do anything that he is told when beginning his practical training and not expect a "sitting down" job when he is undergoing his apprenticeship. The "Improver" type of technical training seems to be the only one possible, and it is worthy of note that where technically-trained students of this type have once been tried, employers are much in favour of the system, and are prepared to take more men. Mechanical Engineering.

202. There are many openings for technically-trained men in this branch of work, and we have found numerous examples of such men receiving from ₹100 to ₹400 per month after they have had two or three years' work in addition to their training. The "Improver" type of training seems to be the most satisfactory method for this branch as well as for mechanical engineering. Electrical Engineering.

In our opinion, and as the result of a most careful enquiry, we find it necessary to point out the fact that there is at present no demand for students

with a university training in mechanical and electrical engineering, and there do not appear to be any openings for which such a man is suitable. The general opinion of employers of labour confirms this.[1]

The feeling seems to exist amongst employers that the university type of education unfits a Bengali for practical work, and although an engineering graduate would have a more complete scientific education he would be far behind the technically-trained student in practical ability and less valuable to an employer.

Coal Mining.

203. There are many openings in the industry for Indians with the right training. We had interviews with all the Chief Superintendents and Managers and have prepared the following scheme which has met with their unanimous approval.[2]

SCHEME FOR TECHNICAL EDUCATION FOR THE COAL MINING INDUSTRY.

1. The classes of men for whom employment is available and who are wanted on the mine fields are—

1. Mine managers.
2. Assistants.
3. Surveyors and draftsmen.
4. Overlookers.
5. Sirdars.

2. By far the most important class of education required is that for men actually engaged in mining work in subordinate positions. As these men are employed underground all day, this education can only be imparted at night schools. These schools then are regarded as the most important part of the scheme.

3. The general scheme of education required is considered to be—

1. Night schools.
2. A school of mines at Asansol.

Night Schools.

4. Subordinate classes for evening lectures should be established at the six centres at present sanctioned; this number to be extended if found necessary. These night schools should be under the direction of the Principal of the School of Mines who should be responsible to the governing body (hereafter described) for their efficiency and control.

Instead of one lecture of one hour a week as at present organised, these lectures should consist of three lectures a week in English of at least $1\frac{1}{2}$ hours' duration in the following subjects :—

1. Mining according to the present syllabus.
2. Steam engines and mechanics.
3. Arithmetic and elementary science.

The staff should consist of three lecturers who may all be attached to the staff of the School of Mines, or partly selected from managers of mines, as may be found desirable. Lecturers attached to the staff of the School of Mines should be permitted to take private practice at the discretion of the Principal, always provided that such practice did not in any way interfere with their educational work.

The School of Mines.

5. This school should be established at Asansol and in addition to a 3 years' course in mining engineering, should hold a one year's course for mine surveyors and draftsmen.

Control.

The governing body should consist of the Chief Inspector of Mines and four members selected by the Indian Mining Association from superintendents and managers of mines one, of whom should be an Indian. The Principal should be *ex-officio* member and secretary.

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[1] See paragraphs 49, 50, 51, 57, 58, 60, 61, 73, 74, 75, 76, 99, 101, 107, 108, 110, 116, 117, 118, 119, 120, 122, 125, 135, 137, 140, 146, 148, 156.

[2] See paragraphs 80, 83, 85, 86, 90, 91.

On the formation of this governing body it is considered that the Mining Educational Advisory Board should be dissolved and its work taken up by the governing body.

Course. The universal opinion expressed is that to enable a man to take proper advantage of a course in a technical school he should prepare himself by a year's practical training in a mine. If this practical training extended to more than a year, it is improbable that a man would leave a paid position to enter the school.

The entrance qualification should in no way be connected with university qualifications, but entrance to the School of Mines should be obtained by one year's practical employment in a mine and through a competitive entrance examination to be held by the school.

The school to be open to all classes and creeds in India.

The general scheme for the 3 years' school course should comprise—

1. Steam, heat, hydraulics and elementary electrical engineering.
2. Mechanism and applied mechanics including the strength of beams.
3. Calorimetry of a simple practical nature.
4. Commercial analyses of coal, general properties of gases in mines and sufficient chemical training to understand these practically.
5. Elementary geology applied to mining.
6. Mining, including ventilation—the course to be of an eminently practical nature.
7. Surveying, including mine surveying and drawing.
8. Practical mathematics and geometry.

The whole education should be carried out with the idea that a student, after obtaining his diploma, should be in a position to carry out the general design of simple machinery and gearing, mine planning, and the buildings and equipment required on a mining estate.

At present a man can appear for the Government mine manager's certificate after five years' practical work underground. It is proposed that the three years of school training should be accepted in place of three years' practical training, and a diploma holder of the School of Mines should be permitted to appear for his mine manager's certificate after two years' practical training, one year of which must precede and one year follow after his school course.

It is considered probable that the Mining Association and the East Indian Railway will grant scholarships to students at the school as they have already done at Sibpur.

Surveying Class. It is considered that as one of the urgent wants on the mine fields is a really efficient mine surveyor, a special class of one year's duration should be established at the School of Mines in which surveying, mine surveying and drawing should be practically taught.

Jute Mills. 204. We found as the result of our enquiries,[1] that there is little or no opening in this industry.

From our own personal inspection of the work demanded, and the difficulties which will be placed in the way of technically-educated Indians, we do not think that this industry need be considered at present, though Mr. Yule[2] was of the opinion that the jute industry might be taken up as a section of the proposed Bengal Technical Institute.

Cotton Mills. 205. There are some openings for men with technical training in this subject, but the field is not large. The demands are at present being met by students educated at existing Textile Institutes.

Industrial Chemistry. 206. We find that there are a few openings for Indians, with a training in Industrial chemistry, but there is not a large or specialized demand at present.[3]

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[1] See paragraphs 50, 76, 77.
[2] See paragraph 76.
[3] See paragraphs 81, 101, 110, 123, 124, 135, 139, 144.

Educational Institutions.

207. We were asked by the Committee appointed to formulate recommendations for an institution to replace Sibpur, to give our opinion on the following questions:—

1. What is the general opinion of employers with respect to the men turned out by Sibpur ;[1] wherein do they fail ; and how would you propose to remove the existing defects ?
2. What are the prospect of employment for students of civil engineering and other branches respectively ?
3. If a Central Engineering College is to be established for the province, should it be in a big town like Calcutta, or, if not, then where ?
4. What qualifications would you recommend for entrance to such a college ; and how should they be tested ?
5. Would the authorities of the United Provinces agree to the founding of a higher engineering college, for all India, elsewhere than at Roorkee ?

Questions 1 and 2.

We are of opinion that a well equipped Institution is of vital necessity to Bengal and one should be established with sections for civil engineering, mechanical engineering, electrical engineering and Industrial chemistry. The present state of the textile industry in Bengal does not justify the existence of a textile section, and the employment of Indians in the jute industry does not seem likely.[2] The mechanical and electrical engineering courses should be separate ones and teach up to the "Improver" grade, granting no certificates till a satisfactory apprenticeship has been completed in accordance with the recommendations in chapter III, page 6.

There is a very large opening for such apprenticeships in Calcutta, though employers are at present prejudiced against technically-trained students. This does not seem to be the fault of the training, but of the material.

These faults which were touched on in paragraph 199 can only be overcome by the rigorous weeding out during apprenticeship of those who will not work. We do not know what openings there are for students of civil engineering, but beyond the Public Works Department there must be a certain number in Municipalities and under contractors.

Question 3.

We are of opinion that this Institute should be located in an easily accessible site on the outskirts of Calcutta and within reach of tramway communication, and not located in the centre of the city.

Question 4.

We are of opinion that the qualifications for entrance should be examinations held independently by the governing body, together with a general education up to the matriculation standard.

Question 5.

We are unable to say what the opinion of the authorities of the United Provinces may be, but Bombay and Madras have large engineering colleges which they are enlarging or rebuilding, the distances in India are great and it is unlikely that any of these provinces will assist in forming a higher engineering college for all India.

Bengal Technical Institute.

208. We inspected this Institute and had the pleasure of meeting the Committee.[3] We are of opinion that neither the equipment, staff or accommodation are of such a nature as to make it probable that the Institute will be successful. We understand the question is under consideration whether it would not be advisable to absorb it in the large Institute now being established for Bengal.

Bihar School of Engineering, Bankipur.

209. We visited this school which is affiliated up to the overseer examination. As this school will be the chief school of the new province, we are of the opinion that it should be developed as a civil engineering school. Overseer classes should be started apart from sub-overseer classes with which they are combined at present. At present three hours a day are devoted to practical work in the workshops. This is not enough to turn out a workman and too much for a sub-overseer. The reason for the introduction of this system was the unpractical nature of the students from Bengal. As only Biharis will be

[1] See paragraphs 49, 53, 57, 58, 59, 60, 64, 68, 71, 75, 80.
[2] See paragraphs 50, 65, 76.
[3] See paragraph 82.

admitted in future it is hoped the system may be altered; a reasonable number of hours a week being allotted to workshops, sufficient to turn out a man who is cognisant of the methods of good work.

The equipment of the workshop is very poor. There is not so much the want of an increase in the plant as good lathes and good tools. We recommend that the entrance test should be examinations held by the school authorities, and more European instructors should be provided. We are of opinion that the school should not be developed in the mechanical or electrical branches, as there is little demand at present in Bihar for such men. The Bengal Institute could be utilized for this purpose at present.

CHAPTER XVII.—CENTRAL PROVINCES.

210. The opinions of employers of labour on which our remarks are based will be found in Part II, page 34.

Provincial industrial developments and the demand for technically-trained Indians.

211. There are few industries yet established in these provinces and the opportunities for employment at present available for technically-trained Indians are not very numerous.[1] It appears that opportunities exist for;

1. Civil Engineers.
2. Engineers for cotton ginning and pressing factories.
3. Surveyors for manganese mining.
4. Assistant superintendents for mines both for coal and manganese.
5. Some few openings in textile mills.

The demands for (1) are at present met by men trained at one or other of the engineering colleges; the appointments are not very numerous and it does not appear necessary to provide for any special educational scheme.

The demands for (2) are more numerous and are at present met by men from Bombay and elsewhere, but with the introduction of the new school of engineering at Nagpur and the development of the technical institute at Amraoti local men can be trained for these appointments.

The openings for (3) are limited in number and would probably be filled by men trained in one of the engineering colleges or at the proposed school of mines at Asansol.

The openings for (4) are also limited and demand no special local facilities for training.

There are some few openings for (5) but not enough to warrant the establishment of any special classes for their training, the largest employers (the Central India Spinning and Weaving Company) having a special training scheme of their own.[2]

Educational facilities for supplying these demands.

212. From what we were able to learn it appears that the engineering school[3] now being started will fill all requirements for some time to come.

Our opinions with regard to the technical school at Amraoti will be found in paragraph 92.

CHAPTER XVIII.—BOMBAY.

213. The opinions of employers of labour on which our remarks are based, will be found in chapter XII, page 42. Of the varied races of the Bombay Presidency, the Brahmin seems least adapted for practical requirements.

Provincial Industrial development and the demand for technically-trained Indians.

214. The industrial development of the Presidency is principally in textile manufacture, there being nearly 200 mills in the Presidency, 90 being located in Bombay Island, 51 in Ahmedabad, and the remainder in various other centres of the cotton industry.

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[1] See paragraphs 84, 85, 86, 90, 91, 92.
[2] See paragraph 95.
[3] See paragraphs 84, 85.

The opportunities for employment of the technically-trained Indians in this province are extremely wide, varied in character, and may be classified under the following heads :—

(*a*) Civil Engineering.
(*b*) Mechanical Engineering.
(*c*) Electrical Engineering.
(*d*) Textile Manufactures.
(*e*) Industrial Chemistry.

Civil Engineering.

215. (*a*) The demand for Civil Engineers of the various grades, appears to be met by the men trained in the College of Engineering at Poona, but from opinions we have gathered [1] it would appear necessary to insist on some practical apprenticeship for these men, under some competent officer.

Mechanical Engineering.

216. (*b*) The demands in this section are principally for engineers in cotton mills, ginning and pressing factories, pumping installations, electric power plants, and engineers for general purposes in factories and industrial concerns, other than mills.

There seems to be little difficulty in obtaining men with adequate training for these posts if they possess the qualifications detailed in paragraph 40, and for many years past Bombay has turned out numbers of these men who are now engaged as engineers in various capacities, and in the majority of instances with satisfaction to their employers.

The demand for these men is not likely to increase to any marked degree in the near future, and it is possible that technically-trained students in mechanical engineering will have to look for some other appointment than that of engineer in a ginning factory for 5 months out of the 12 ; this position is much sought after by the majority of technically-trained students. We are of opinion that if the wants of employers are to be met, and a better class of mechanical engineer is to be provided, an apprenticeship of two years must be insisted on by the authorities.

Electrical Engineering.

217. (*c*) The demand for properly trained electrical engineers is likely to increase, and with the installation of the Tata hydro-electric scheme the possibility of employment in this branch of engineering appears to be good.

The educational course should include a two years' apprenticeship in an electrical workshop, so far as to ensure that the student will work under practical conditions.

Textile Industry.

218. (*d*) The demands for technically-trained men in the textile industry are very great, and we find that almost every mill is willing to take these men, provided they will comply with mill rules and hours. There appears to be no complaint about the knowledge and ability of the technically-trained Indians for textile work, but there is undoubtedly a strong and well-founded objection to employing men who consider it beneath their dignity to do any practical work themselves, but simply wish to direct others. The two years' apprenticeship should also be insisted on for textile students, and we feel sure that if this is done, the objections raised against giving employment to technically-trained Indians in mills will disappear.

With regard to a class for training mill jobbers in the elementary theoretical portion of their work, it does not appear necessary in view of the few promises of support given, to start such a class at present, but the authorities should not lose sight of the fact that a necessity may arise in the future.[2]

Industrial Chemistry.

219. (*e*) [3]The opportunities for employment in Industrial chemistry are not yet very numerous; in some few instances the mills will engage men with a knowledge of chemistry as applied to bleaching, sizing, and dyeing.

There appear to be some openings for men with a small capital and the requisite chemical training, in the manufacture of oils, fats, and lubricating materials, size, paint, and varnish manufacture, and the Victoria Jubilee Technical Institute is introducing these trade classes, in connection with its existing

[1] See paragraphs 21, 104, 112.
[2] See paragraphs 99, 101, 108, 117, 118.
[3] See paragraphs 81, 101, 110, 123, 124, 135, 139, 144.

chemistry courses. It also proposes to take up the training of men as inspectors for food and drugs, when there is shown to be a demand for such men.

Facilities for technical education.

220. Facilities for technical education in the Presidency are well provided and need no special mention. For opinions regarding the existing courses at the Ahmedabad Technical Institute reference should be made to chapter X,[1] page 42.

Advanced Training.

221. The opinion of the majority of employers interviewed in Bombay is that no opening for a man with high theoretical training exists, and that unless such men are prepared to do practical work for some years, their knowledge is valueless.[2]

Poona College of Engineering.

222. This college[3] teaches up to the B.E. degree of the Bombay University in civil, mechanical and electrical engineering. The civil engineering class has been long established and meets the demands of the Bombay Public Works Department. The mechanical and electrical engineering classes are either not yet established or have only recently started. A very fine mechanical laboratory is now being built. To show that the openings for employment of such men are not numerous reference may be made to the opinions referenced in paragraph 221.

There is also an apprentice class for sub-overseers, mechanical engineers and electrical engineers. The men all have to work together for two years taking up drawing, mathematics, steam oil engines, physics, mechanics, chemistry and practical workshop training. In the third year the students specialize in civil, mechanical or electrical engineering. In our opinion this system is unlikely to turn out either a sub-overseer or a mechanical or electrical engineer of the type demanded.

There is also a normal class which selected students may attend for a fourth year during which they are paid ₹40 a month. They are then apprenticed out for one year in workshops. In our opinion efficient teachers will require a longer period of practical experience.

CHAPTER XIX.—MADRAS.

223. Besides the interviews detailed in Chapter XI, page 56, we had conversations with the Hon'ble Sir Murray Hammick, Member of Council for Education, and the Hon'ble Dr. A. Bourne, Director of Public Instruction.[4]

The industries and the inhabitants of Madras.

224. The main industries of Madras are agriculture and the hand-loom industry. The larger industries with which technical education is allied are not highly developed and are represented by a few, but very efficient cotton mills, small engineering workshops in Madras, and some sugar factories. There is a very large demand for men to run ginning factories, rice hulling machines, and small oil engines for pumps. The wages available are usually low and not sufficient to tempt educated men, even of the Improver grade, for whom there seem few openings. The chief want at present, seems to be for more highly skilled mechanics to fill these posts.[5]

As workmen, we heard good accounts of the inhabitants of Madras. The larger percentage of the higher classes, however, are Brahmins who we were informed as a race suffered from the same disabilities as detailed in paragraph 199. The opinion was expressed that the lower social classes of Madras would probably be most suitable for a technical education.

Civil Engineering.

225. The College of Engineering, Madras, is an old established institution, and the courses are referred to in paragraph 132.

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[1] See paragraphs 122, 123, 125, 126.

[2] See paragraphs 99, 101, 107, 108, 110, 116, 117, 118, 119, 120, 122, 125.

[3] See paragraphs 104, 111, 112, 119, 166.

[4] See paragraphs 133, 134.

[5] See paragraph 130.

The opinion seemed to be that the men turned out are weak in practical work, and this was not due to the training but to the unsuitability of the material.[1]

Mechanical Engineering.

226. The class at the College of Engineering is of the "University type," and it appears from the opinion almost universally expressed in the appendices that there are few openings for the employment of such men.[2] It is very doubtful if Madras is at present sufficiently industrially developed for a technical institute teaching to the "Improver Grade." If such an institute is started, it is recommended that it should be recruited from the classes who are willing and able to work with their hands. The great need is undoubtedly for a superior class of skilled mechanics and the scheme detailed in paragraph 130 seems a very promising one.[3]

Electrical Engineering.

227. The remarks made in the above paragraph refer equally to electrical engineering. The Cauvery power installation gives employment to few Indians above the grade of skilled mechanics, and these posts will ultimately be filled by inhabitants of Mysore. This state sends an average of 10 students yearly to the Bombay Technical Institute for training.

The Textile Industry.

228. The openings in this industry do not warrant the establishment of a special institution in Madras, but assistance should be given to the efforts now being made for the training and education of the mill operatives as detailed in paragraph 135.

The Mining Industry.

229. As shown in paragraph 128 there is no opening for employment in the Kolar Gold Fields above the grade of skilled mechanics.

CHAPTER XX.—UNITED PROVINCES.

The United Provinces and their inhabitants.

230. In these Provinces, though chiefly agricultural, the major industries are to a certain extent established in a few centres. The number of factories is, however, small, and at present cannot give apprenticeships or employment to many students. The inhabitants of these Provinces are by nature better fitted for technical education than those of any province except the Punjab. Technical training, as far as our report is concerned, is to a great extent concentrated in the Thomason College, Roorkee. A separate note on this institution has been forwarded to Government. To gain practical experience students will have to a great extent to go far afield for their apprenticeships, but there is now no difficulty in obtaining these, and the students are welcomed as apprentices by employers in other provinces. The return of these trained men cannot but benefit the development of the Provinces.

Technological Institute, Cawnpore.

231. A technological institute for industrial chemistry is to be established at Cawnpore.

Industrial Schools.

232. There are two industrial schools, one at Lucknow and one at Gorakhpur. The result of our enquiries regarding such schools is expressed in paragraph 190. Owing to the numerous changes in the regulations and courses which have been made in past years at the Lucknow Industrial School, we understand it has been decided that no radical changes are to be made for at least 5 years in the present system; a decision which we recommend should be adhered to.

The Textile Industry.

233. From the interviews detailed in Chapter XII, page 61, it will be seen that the general opinion is that Indians of good social position do not and will not make suitable material for employment in mills.[4] The men required are, as elsewhere, men well educated theoretically and practically who are prepared to work along side with workmen and coolies, and win their way up by practical experience.

Skilled and unskilled labour are both scarce in Cawnpore, and we are strongly of the opinion that some steps should be taken for the education of the workmen in the factories and of the children, preferably on the lines suggested in paragraph 193.

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[1] See paragraphs 129, 138.
[2] See reference to paragraph 25.
[3] Chapter XV, paragraphs 186—194.
[4] See paragraphs 144, 146, 147, 154, 155, 156.

CHAPTER XXI.—PUNJAB.

The Punjab and its inhabitants.

234. Major industries are very slightly developed at present in the Punjab. Various hydro-electrical schemes for the production of power are, however, under consideration, and there seems no doubt that in the near future cheap power will be available in various parts of the province as a forerunner of industrial development.

The inhabitants are particularly adapted by nature for technical education, turn into excellent mechanics, and are by far the best material in India for engineering training of every description.

Civil Engineering.

235. The demands for training are at present amply met by the Thomason College, Roorkee. An engineering school teaching up to the sub-overseer standard has lately been established at Rasul, the idea being to offer facilities for the training of the Mahomedans of that part of the Punjab who at present do not go to Roorkee.

Mechanical and Electrical Engineering.

236. The openings in the Punjab do not point to the advisability of establishing an Institute for training in these professions. The splendid material should, however, be sent and encouraged to go to the established Institutes in other provinces for training and apprenticeship. The return of practical and qualified men cannot fail to have an effect on the industrial development of the Province.

The Jubilee Technical Institute, Lahore, has neither the equipment nor staff to deal with this class of education, and at present is a danger rather than a public benefit. The Rasul school will probably take up training in electrical engineering if opportunities for employment develop to any extent.

Skilled labour.

237. We consider that every effort should be made to afford education of the type required for workmen and their children, and our recommendations are expressed in paragraph 193.

Textile Industry.

238. This is curiously chiefly hampered by the scarcity of labour in a province famous for its workmen. The wages obtainable by workmen and labourers are so high that employment in mills is not popular; and the very fact that the excellent workmen of the Punjab are eagerly sought after in all parts of India acts as a drag on the success of industries in the Punjab. The climatic conditions are undoubtedly against the success of weaving. There is no scope for a textile institute in the Punjab, and advantage should be taken of those established elsewhere.

Industrial Chemistry

239. There are not at present sufficient openings to justify any great expenditure on teaching this subject.

CHAPTER XXII.—RAILWAYS.

The railways of India.

240. The railways of India require a separate chapter, being by far the largest employers of technically-trained Indian labour. They present, however, several unique features. They almost universally wish to employ and train the relatives of their employees, they have their own system of railway schools, and in many instances have systems of technical education of their own.[1]

Civil Engineering.

241. In the engineering department there are a fair percentage of Indian employees, and the existing engineering colleges meet the present demands. The training given in these colleges is admittedly of a high standard, and it simply depends on the fact that if the character of the material which is coming forward is of a suitable nature, appointments in the higher grades will always be available. Opportunities for the practical training of college students might be made more numerous.

Permanent-way Inspectors.

242. An almost universal dissatisfaction was expressed with the present recruitment and training of Permanent-way Inspectors. The recruitment is usually from European or Eurasian statutory natives, though Indians are

[1] See paragraphs 63, 75, 81, 119, 149, 160.

also employed. The reasons for this dissatisfaction are given in a note by Mr. E. F. Sanders, Chief Engineer, Bengal-Nagpur Railway, reprinted in paragraph 161, and the matter has been considered sufficiently important to have a separate Chapter (XIV, page 70) devoted to this subject. The standard of training necessary is also given in paragraph 6 of this note, and is generally approved of by Chief Engineers except it is considered that "the principles of signalling and interlocking" should be added.

We have also corresponded with the Secretary of the Permanent-way Institution of India, which Institution is naturally interested in the subject.

Suggestion for training Permanent-way Inspectors.

243. We find it is a curious fact, that though there are four large engineering colleges established in India, the railways make little or no use of them. There is little difficulty connected with the training of permanent-way inspectors, signal inspectors or other necessary subordinates if the existing engineering colleges and mechanical institutes of the country are made use of and the railways themselves undertake to give the final practical training.

After discussing the question with chief engineers of railways we suggest that classes for permanent-way inspectors should be started in the various engineering colleges; the recruits to be nominated by railways, who will undertake to give the necessary practical apprenticeship after the college course; an entrance examination to be held to ensure the candidate has sufficient general education to follow out the college course which will work in with the overseer classes of the colleges as far as is practical. This scheme meets the support of a number of chief engineers as may be seen from Chapter XIV, page 70, and if it is to be seriously considered we recommend that the Railway Board should call a Conference of Chief Engineers and Principals of Colleges at which it is proposed to establish these classes, to work out the necessary details.

Mechanical Engineering.

244. At first sight it will be thought there would be an enormous demand and great facilities for training men of the "Improver Grade" in the great railway workshops in this country. As a matter of fact there is little opening for this grade. But railways require a host of skilled mechanics, some of whom rise to chargemen and foremen, the superintendents of departments being practically skilled Europeans whom it would be very difficult for Indians to replace. Even as a training ground for apprentices of the "Improver Grade" the railway workshops are not generally suited. There is undoubtedly a clannish feeling among the Indians employed in these shops; technically-trained apprentices are frequently treated by the foremen and chargemen as outsiders, and very often can get little training or assistance. Loco. shops are specialized erecting and repair shops and offer little facility for a general apprenticeship, while nearly every railway has its own system of training apprentices.

Engine drivers.

245. It has not been found possible to induce students from technical institutions to take up this line of work. The apprenticeship necessary is too hard and generally uncongenial to students educated at an Institute. The present arrangements made by railways to train their own men seems as satisfactory a method as can be devised.

Electrical Engineering.

246. In the electrical branch, however, there is quite a large opening for apprenticeship and employment of technically-trained students of the "Improver Grade" chiefly in the Signal Engineers' department, and in the train lighting systems of the Loco. department. And, for purposes of training pure and simple, it will be seen from Part II that Railways are universally willing to take apprentices of the "Improver Grade" from all institutions.

Skilled mechanics.

247. This class of man is employed in the railway workshops in thousands, and we recommend for the improvement of the training of the future generation the scheme detailed in paragraph 193.

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CALCUTTA: PRINTED BY SUPDT. GOVT. PRINTING, INDIA, 8, HASTINGS STREET.